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SMITH (L. M.) & GOLDSMITH (E. V.). **The Cyclamen Mite,** *Tarsonemus pallidus*, **and its Control on Field Strawberries.**—*Hilgardia* **10** no. 3 pp. 53–94, 8 figs., 26 refs. Berkeley, Calif., March 1936. [Recd. November 1936.]

An account is given of the distribution and bionomics of the cyclamen mite, *Tarsonemus pallidus*, Banks, which attacks strawberries grown in the field in several parts of the United States. In California, it occurs in most strawberry-growing districts, except in the south-east, where it is probably exterminated by high temperatures and low humidities. Economic injury is most severe in the coastal regions.

On strawberry leaves at 16–21°C. [60·8–69·8°F.], the eggs, larval and nymphal stages lasted 3–4, 1–4 and 2–7 days, respectively. The nymphal stage is inactive and is passed within the larval integument, from which the mite does not emerge until it becomes adult. Most of the mites on a plant are found in the unopened leaflets in the centre of the crown, but some also occur on the flowers and sometimes on the green seeds of the immature berries (but only before the styles are dry). They need a high relative humidity and can survive submergence in cold water for some hours. They frequently withstand winter temperatures below freezing point, and adult females and larvae lived for 3 days on strawberry leaves that were frozen in water. Prolonged exposure to 100°F. killed them. In the areas of California where the temperature often rises above 100°F., no mites were found, but low humidity may contribute to this. Adult females overwinter in the crown of the plant, and usually resume activity in late February, when they migrate to the centre of the crown and oviposit. In the field, males do not normally overwinter, but appear in May and increase slowly until the cold weather. On the average, males constitute about 5 per cent. of the total population, but late in the season they may comprise about 30 per cent. Under greenhouse conditions, *T. pallidus* attacks many plants, a list of which is quoted from a paper already noticed [*R.A.E.*, A **22** 128], but only two records of its occurrence in the field on plants other than strawberry were obtained in the United States, both from *Delphinium*. Many native species of *Fragaria*, *Potentilla* and *Geum* were severely injured when the potted plants were infested by hand, but no mites survived the winter on them or occurred on them under natural conditions. A list is given of the resistant and susceptible varieties of strawberry.

Although *T. pallidus* is usually introduced into new plantings with infested stock, fields may also be infested by natural spread; in one case where an infested and an uninfested field were only separated by a road, the intensity of the infestation that arose in the new field varied with the distance from the old one. In all parts of California, a predatory mite of the genus *Seiulus* feeds on *T. pallidus* on strawberries, and under certain conditions may give effective control. It is possible that some varieties of strawberries are resistant because they favour the development of the predatory mite rather than *T. pallidus*.

In experiments on control in the field, dusts of calcium cyanide, sprays and dusts of nicotine, and sprays of selocide (potassium ammonium seleno-sulphide) were unsuccessful; and in laboratory tests, naphthalene and carbon bisulphide as fumigants were also unsatisfactory. In experiments carried out from 1930–31 onwards on the value of immersion of the dormant plants in hot water, complete control was always obtained by immersion for 20 mins. at 110°F. and

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the plants were not damaged after an hour's immersion at this temperature. Treatment for 20 mins. was also shown to kill the eggs. In one series of tests in 1932–33, the plants were immersed at 109, 110, and 111°F. for ½, 1, 1½, and 2 hours. On examination about 1 month later, a few mites were found on plants that had been immersed for ½ and 1 hour, but they proved to belong to another species of *Tarsonemus*. This species is abundant on raspberries, some of which grew in a field adjacent to the strawberries, but does not appear to injure the latter. It is more resistant to heat treatment than *T. pallidus*, only 81·6 per cent. being killed after raspberry canes had been immersed for an hour in water at 110°F.

The application of the heat by means of hot air and water vapour was then investigated [*cf.* **20** 429]. Batches of plants were subjected to temperatures of 110°F. and 114°F. for various periods at a relative humidity of 99 per cent. Of the plants treated for 25 mins. at 114°F., 8 out of 10 were freed from living mites, and all the mites on plants subjected to either temperature for 45 mins. or more were killed.

Three varieties of strawberry were tested to determine the effect of the hot water treatments on the growth of the plants. The most susceptible to treatment was injured after immersion for an hour at 109–111°F. Plants of another variety, after treatments of ½ and 1 hour, grew more vigorously than the control plants. The average number of flowers and fruits produced by 10 plants was considerably reduced by treatment, but the average weight of 10 plants was hardly altered. The reduction of flowers is of no practical importance, as in the commercial fields the flowers are removed from the plants during the first year. To determine the varietal tolerance to heat treatment, 10 varieties and selections were immersed for 1 hour in water at 110°F. Batches of each variety were treated on 4th and 20th February, and 3rd and 18th March, and after treatment all lots were planted with controls out of doors. On 29th March all flowers and fruiting stalks were picked and weighed, and on 2nd June all the plants were dug and weighed. The reduction in weight of the whole plant (including flowers and fruit) varied with the variety from 4·9 to over 40 per cent.; in only 2 varieties was the reduction less than 20 per cent. The average reduction in weight (for all varieties) was greatest in plants treated on 20th February, and least in those treated on 18th March. In general, however, it appeared that the apparently fully dormant plants are the more susceptible to heat injury, retardation in growth being probably due to moving the plants during the dormant periods. Further tests, confined to a single variety, showed that runner production increased, and the weight of the reproductive structures slowly decreased, with an increase in the period of immersion. In a comparison of the effects of the two treatments on different varieties of strawberry, the runner production was slightly greater after the vapour treatment, and except in one case, there was a greater increase or a smaller reduction in the weight of the plant after treatment by the vapour method. Experiment showed that plants held in storage at 34°F. for 2 weeks following treatment were slightly more vigorous than those treated without storage or stored without treatment.

It is concluded that a complete kill of the mite is obtained by exposure to 110°F. for 20 mins. in water or 45 mins. in saturated air, but that in practical work the treatments should be continued for ½ hour and 1 hour respectively, and the plants dried with care.

GLEN (R.), KING (K. M.) & ARNASON (A. P.). **The Wireworm Problem of Garden, Potato and Truck Crops in the Prairie Provinces.**—*Saskatoon Leafl. ent. Br. Dep. Agric. Canada* no. 44, 5 pp., multigraph, 2 refs. Saskatoon, Sask., October 1936.

The measures recommended for the control of wireworms attacking vegetable crops in western Canada are summer fallowing [*cf. R.A.E.*, A **21** 479 ; **24** 363] ; the careful selection of sites for gardens ; the use of pieces of potato as baits ; and soil fumigation with naphthalene. The effectiveness of potato baits varies according to factors not yet fully understood, but the method is one of the cheapest controls known and is particularly suitable for small gardens. The potatoes should be cut in half, or sliced on one side if small, so that one moist surface is exposed, and should be placed in moist warm soil at a depth of 2–3 ins., and about 3 feet apart. Very small ones should not be used as they dry out too rapidly.

Recommendations for soil fumigation with naphthalene are based on its successful use in Washington [**22** 355], and also on some preliminary experiments under dry-land conditions in Saskatchewan. When properly applied, this material gives from 85 to 100 per cent. control. It should be 95 per cent. pure and, if lumpy, should be ground or passed through a $\frac{1}{4}$-in. sieve to ensure even distribution. It should be ploughed into the soil at the rate of 700–750 lb. per acre during a prolonged hot period when the temperature of the soil at a depth of 6 ins. is 70°F. or more. Ploughing should be to a depth of at least 7 inches, and a single furrow plough with a share of not more than 12–14 inches should be used. The naphthalene should be evenly distributed along each furrow from the bottom to the top of the freshly turned soil. An even distribution is often more easily obtained by mixing the naphthalene with an equal quantity of fine dry soil. It should then be thoroughly worked in by a cultivator, the operation to be as deep as possible and preferably to be carried out twice, once in each direction. The use of a float for levelling the surface is desirable, as it probably assists in retaining the gas given off.

KAMESAM (S.). **A Note on Protecting Indian Structural Timbers against Fire, Termites, Borers and Fungi (Rot).**—*Indian For. Rec.* (N.S.) Utilisation **1** no. 4 pp. 91–113. Delhi, 15th October 1936.

This paper deals primarily with the means of protecting timber in India from attack by termites and fungi. On the basis of 10 years' experience, lists are given showing the relative susceptibility of different Indian timbers to such attack, the timbers being divided into 4 categories according to the durability of the heartwood and kind of treatment required for its preservation. The classifications range from the category of the most resistant timbers, which need no treatment unless out of doors, in which case they must be brushed with a preservative, to that of the least resistant, which require a high pressure treatment if exposed out of doors and a low pressure treatment for indoor use. Experiments at Dehra Dun [*cf. R.A.E.*, A **22** 684] have shown that even the most rapidly perishable woods and the sapwood of practically any timber can by proper antiseptic treatment, be made more durable than the most resistant timbers, which include *Shorea robusta, Cedrus deodara, Tectona grandis* (teak), *Zylia dolabriformis* and *Mesua ferrea* ; and that even the most naturally

durable wood requires antiseptic treatment under pressure for use as a pole or post if it is to last for more than about 15 years. Tests in which veneers were placed vertically in ground infested with termites and fungi indicated that in most cases of injury by termites, attack by fungus is a prelude. The cost of preservative measures and the amenability of the various timbers to impregnation under pressure with antiseptic fluids are discussed.

SCHEDL (K.). **Notes on Malayan Scolytidae and Platypodidae and Descriptions of some new Species.**—*J. F.M.S. Mus.* **18** pt. 1 pp. 1–18. Kuala Lumpur, December 1936. **Some new Scolytidae and Platypodidae from the Malay Peninsula.**—*T.c.* pp. 19–35, 1 fig.

Among the new species described in the first paper are *Xyleborus pseudopilifer*, *Crossotarsus impar* and *Platypus transformis*, all of which have been taken from the living wood of species of *Shorea* in Malaya. *X. pseudopilifer* has also been found in North Borneo.

MILLER (N. C. E.). *Dasynus piperis* **China. (Heteroptera—Coreidae). A minor Pest of Pepper** (*Piper nigrum* **L.**).—*J. F.M.S. Mus.* **18** pt. 1 pp. 109–116, 2 pls., 4 refs. Kuala Lumpur, December 1936.

Descriptions are given of all stages (including the 5 larval instars) of the Coreid, *Dasynus piperis*, China, which attacks pepper (*Piper nigrum*) in Malaya. Both nymphs and adults have also been observed on *Citrus*. The eggs are deposited on the upper surface of the leaves of pepper, or occasionally on the fruits. The nymphs and adults both feed on the fruits. In the laboratory, the eggs hatched in 4–8 days, and the 5 instars lasted 2–8, 5–9, 3–7, 4–8, and 7–8 days, respectively. The eggs of this Coreid were parasitised by *Anastatus dasyni*, Ferrière, and *Ooencyrtus malayensis*, Ferrière [*cf. R.A.E.*, A **22** 60; **23** 588]. *O. malayensis* also seems to parasitise *A. dasyni*, and has been bred in Malaya from eggs of *Cephonodes hylas*, L., *Papilio polytes*, L., and *Leptocorisa* sp., and reared in the laboratory on eggs of Pentatomids (*Nezara* and *Plautia fimbriata*, F.).

SCHWEIZER (J.). **Jaarverslag Tabak over Juli 1935 t/m Juni 1936.** [Annual Report on Tobacco from July 1935 to June 1936, inclusive.]—*Meded. Besoekisch Proefst.* no. 55, 51 pp. [Djember] 1936.

Insect pests of tobacco in the Besoeki region, Java, are dealt with on page 39. As in all dry years, the plants were infested by *Myzus persicae*, Sulz. An emulsion of solar oil, glue and soap at concentrations of 1 : 200 and 1 : 300 killed all the Aphids without scorching the tobacco, and it is believed that a more diluted spray might prove equally effective. The Cicadid, *Lawana candida*, F., was plentiful on tobacco in one plantation, apparently having been carried by wind from *Spathodea* growing along a road. *Phthorimaea heliopa*, Lw., *Prodenia litura*, F., and *Dasus* (*Opatrum*) *acutangulus*, Fairm., were injurious in some places. Dermestid larvae found in stored tobacco seed produced adults, apparently of the genus *Orphinus*, the progeny of which were reared in tobacco seed.

UICHANCO (L. B.). **Miscellaneous Notes on Locusts, Agriculture and People in Mindanao.**—*Philipp. Agric.* **25** no. 7 pp. 565–588, 11 figs. Laguna, P.I., December 1936.

In order to discover the permanent reservations of *Locusta migratoria manilensis*, Meyen, the author made a survey of Mindanao and neighbouring islands in April and May 1936. The reservations apparently occur in areas where Manila hemp (*Musa textilis*) is abundant ; the ferns, *Dryopteris dissecta* and *Nephrolepis hirsutula*, are common in such habitats, but *Melastoma* sp., which requires very humid conditions, is absent. Locusts were found all over Mindanao, but were particularly numerous in Bukidnon Province, where they caused serious damage to pastures, showing preference for *Themeda gigantea*, one of the most useful pasture grasses. Some damage was also done to coconut palms. Control was carried out by means of poisoned bait, prepared with bagasse ; it is recommended to add to it newly killed hoppers, to act as an attractant.

In one part of Bukidon Province, branches of mangos and other trees were laden with adults of *Leucopholis irrorata*, Chevr., and everywhere the leaves of mangos were whitened by the attacks of the leafhopper, *Typhlocyba nigrobilineata*, Melichar. In Davao, cacao pods were severely injured by the larva of a Tineid, *Acrocercops cramerella*, Sn., and Manila hemp by *Odoiporus longicollis*, Ol. Unlike *Cosmopolites sordidus*, Germ., which infests only the underground parts, this weevil works through the whole length of the stem, making the entire plant useless for stripping. Infestation is, however, confined to plantations at an altitude of over 2,600 ft.

BARBEY (A.). **L'insecte, élément de dislocation de la forêt européenne.** —*Livre jubil. E. L. Bouvier* pp. 105–110. Paris, 1936.

The relative importance of primary and secondary insect pests of forests in Europe is briefly discussed. Among the primary pests, the most injurious are Lepidoptera and sawflies, though they also include *Hylobius abietis*, L., and *Melolontha melolontha*, L. (*vulgaris*, F.). Conifers are considered to be less resistant to attack than deciduous trees, and it is suggested that mixed stands of trees of different ages should gradually be planted to replace susceptible forest [*R.A.E.*, A **23** 347].

PAILLOT (A.). **Problèmes posés par l'étude de l'entomologie appliquée.**— *Livre jubil. E. L. Bouvier* pp. 259–262. Paris, 1936.

The author refers to the way in which the problems of applied entomology involve consideration of other branches of science, and briefly reviews work on bacterial and virus diseases of insects in connection with biological control. He points out that such work is not likely to give practical results until more is known of immunity in insects and the factors that render them liable to epidemics.

RAUCOURT (M.). **Les produits nouveaux utilisés par l'agriculture comme antiparasitaires.**—*Chim. & Industr.* **35** no. 6 repr. 15 pp., 20 refs. Paris, June 1936. [Recd. December 1936.]

In this paper, which is compiled from the literature, recently developed fungicides, insecticides and wetting agents for sprays are discussed from the chemical point of view.

LENTZ (O.) & GASSNER (L.). **Schädlingsbekämpfung mit hochgiftigen Stoffen.** [Pest Control with highly poisonous Substances.] **Heft 1. Blausäure. Deckblätter—2. Folge.** [Hydrocyanic Acid Gas. Addenda—2nd Series.]—6 pp. Berlin, R. Schoetz, 1936. **Heft 2. Aethylenoxyd (T-Gas und Cartox). Deckblätter—2. Folge.** [Ethylene Oxide. Addenda—2nd Series]—14 pp., 1 fig.

These supplements to two booklets already noticed [*R.A.E.*, A **22** 369; **23** 425] contain recent regulations dealing with the employment of hydrocyanic acid gas and ethylene oxide as fumigants in Germany, and instructions for using ethylene oxide.

SCHWERDTFEGER (F.) & KEMPER (A.). **Ueber den Zeitaufwand bei Probesuchen nach Eiern, Raupen und Puppen forstschädlicher Insekten.** [On the Time required for taking Samples of Eggs, Larvae and Pupae of Insect Pests of Forests.]—*Forstarchiv* **11** no. 17 pp. 285–288. Hanover, September 1935. [Recd. December 1936.]

The possibility of controlling various forest pests in Germany by means of dust insecticides has enhanced the importance of accurate forecasts of infestation. In the case of the pine Geometrid, *Bupalus piniarius*, L., and the pine Noctuid, *Panolis flammea*, Schiff., forecasts are based chiefly on collections of the pupae and counts of the eggs and larvae in the tree crowns. Examples of such work in practice are cited as some indication of the time required to carry it out.

SCHWERDTFEGER (F.). **Studien über den Massenwechsel einiger Forstschädlinge. II. Ueber die Populationsdichte von *Bupalus piniarius* L., *Panolis flammea* Schiff., *Dendrolimus pini* L., *Sphinx pinastri* L. und ihren zeitlichen Wechsel.** [Studies on the Variation in Abundance of some Forest Insects. II. On the Population Density of *B. piniarius*, *P. flammea*, *D. pini* and *S. pinastri* and its Fluctuation.]—*Z. Forst- u. Jagdw.* **67** nos. 9–10 pp. 449–482, 513–540, 21 figs., 63 refs. Berlin, September–October 1935. [Recd. December 1936.]

This detailed study of population density of *Bupalus piniarius*, L., *Panolis flammea*, Schiff., *Dendrolimus pini*, L., and *Sphinx pinastri*, L., in its variation over a long period from a normal abundance to a maximum, is based on collections in December of larvae and pupae in the ground of pine forests in various parts of Prussia. The variation in abundance in various years of each of these species is followed in the various phases of progression from normal to maximum and retrogression to normal.

The following is taken from the summary: The development potential (maximum possible annual increase of an individual) is 36 for *B. piniarius*, 75 for *P. flammea*, and 100 for *D. pini* and *S. pinastri*, the normal destruction quotients being 97, 98·67, 99 and 99 per cent. respectively. The density curves of these species do not generally run parallel. The normal abundance is not a fixed quantity; its population density varies constantly. On an average, the normal abundance is 0·025 pupae per sq. metre for *B. piniarius*, 0·012 for *P. flammea* and *D. pini*, and 0·016 for *S. pinastri*. The longest

latent period (period in which the numbers of the insect are below normal and are not increasing) was generally shown by *D. pini* and the shortest by *B. piniarius*, *P. flammea* having a somewhat longer period than the latter. The interval between the peaks of abundance of the species in a forest typical of it averaged 10 years for both *B. piniarius* and *P. flammea*.

SCHWERDTFEGER (F.). **Untersuchung über die Eignung von Kalidüngemitteln zur Bekämpfung des Engerlings** (*Melolontha melolontha* **L. und** *Melolontha hippocastani* **F.).** [Investigations on the Suitability of Potash Manures for combating *M. melolontha* and *M. hippocastani*.]—*Z. Forst- u. Jagdw.* **68** no. 4 pp. 177–209, 9 figs., 29 refs. Berlin, April 1936. [Recd. December 1936.]

As potash manures have been recommended for the control of Melolonthid larvae in Germany [*cf. R.A.E.*, A **23** 252], tests of their value were made in the laboratory and in plantations of young pine and larch trees. The experiments are described in detail, and it is concluded that potash manures have little effect on *Melolontha melolontha*, L., and *M. hippocastani*, F. The larvae are resistant both to the specific toxicity of the salts and to the change in osmotic conditions produced in the soil, and, if they need to do so, they can migrate below the treated layer. For satisfactory control, the requisite quantities of kainit would be costly and likely to injure the plants. Subklew has carried out laboratory work to complete the practical tests and investigate the theory involved [**24** 653].

SCHWERDTFEGER (F.). **Beiträge zur Kenntnis des Kiefernspinners,** *Dendrolimus pini* **L., und seiner Bekämpfung.** [Contributions to the Knowledge of *D. pini* and of its Control.]—*Mitt. Forstwirt. Forstwiss.* 1936 no. 2–3 pp. 169–242, 45 figs., 37 refs. Hanover, 1936.

From 1933 to 1935, injury to pines by *Dendrolimus pini*, L., occurred in some small areas in forestry districts near Potsdam. Observations in 1934–35 on its biology and control are described in detail, preceded by an account of laboratory investigations on its ecology and physiology made in 1931 with material from Anhalt.

The following is taken from the summary : In the laboratory, the eggs were very resistant to different combinations of temperature and humidity, and the larvae were also resistant, though not to so marked a degree. The larvae fed more in darkness than in light. Pupal mortality was generally slight, reaching high values only at the highest and lowest temperatures.

In the field, phenological observations were made on the ascent of the trees by, and further development of, the overwintered larvae, pupation and the pupal stage, the flight of the adults, oviposition and hatching, larval development in autumn, descent of the larvae from the tree and hibernation. The adults flew from stands where feeding had occurred to stands in which the needles were intact. The eggs were laid on the shoots in the lower and middle thirds of the crown. In contrast to the laboratory observation, the larvae fed fairly regularly by day and night, but between 6 and 24°C. [42·8 and 75·2°F.] feeding increased with the temperature. The influence of rain and air humidity on the larvae was masked by other factors. The larvae

crawled for comparatively long distances, but without any definite direction, so that an extension of infestation by them is unlikely to occur. There were more hibernating larvae under heather than under pure needle litter. Observations on them indicated that a two-year life-cycle is the rule in North Germany during the interval between outbreaks, and that a change to a one-year life-cycle is one of the factors that lead to an increase.

As regards control, no success attended experiments in which the base of the tree was dusted with a contact poison to kill larvae crawling up after hibernation. Used in comparatively large quantities, contact dust insecticides gave satisfactory results against the larvae feeding in the crowns, but the cost was several times that of adhesive bands, which, if properly applied at the right time, prevent the overwintered larvae from reaching the trees.

SPEYER (W.). **Die Entwicklung von *Psylla mali* Schm.** [The Development of *P. mali*.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 4 pp. 267–283, 10 diagr., 4 refs. Berlin, 10th December 1936.

Observations on the development of *Psylla mali*, Schm., attacking apple in the orchard districts of the Lower Elbe [*R.A.E.*, A **17** 484] were continued up to 1935 in order to ascertain its relation to weather. Supplementary experiments at various temperatures were also made in the laboratory.

The following is chiefly taken from the author's summary. Egg development, suspended during the winter, began again about 1st March, from which date onwards the outdoor temperature began to affect it. The eggs hatched when a sum of temperatures of about 181°C. was attained, starting from 1st March. The later the eggs hatched in spring, the quicker was the nymphal development completed, because of the greater warmth at the later dates. Hyperbolic curves were calculated for all 5 nymphal instars. In some instars, the field values were different from those found experimentally or by calculation. The development of the apple leaves was not influenced by climate in the same way as nymphal development, and there was no fixed relation between the latter and the length of the leaves, so that injury varied in different years. Oviposition began regularly in the last third of August, 90–100 days after the appearance of the first adults, and during the intervening period there was an average sum of temperatures of 1,430–1,490°C. Development of the ovaries was interrupted from mid-July to mid-August.

HELLER (K. M.). **Ergänzende Bemerkung über kartoffelschädigende Rüsselkäfer.** [A complementary Note on Weevils attacking Potato.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 4 pp. 284–285, 1 fig. Berlin, 10th December, 1936.

From an examination of the illustrations given by Pierce in recording a weevil on potato in Peru as *Rhigopsidius tucumanus*, Heller [*R.A.E.*, A **1** 546; **2** 241], the author concludes that it is a distinct species, for which he gives some characters, naming it *R. piercei*, sp. n. He also considers that the genus *Plastoleptops*, recently erected by him [**24** 200], is identical with *Premnotrypes* [**2** 241], but is not certain whether the type, *solanivorax*, is a synonym of *P. solani*, Pierce.

Speyer (W.). **Ueber die Entwicklung und Organisation der landwirtschaftlichen Entomologie in Deutschland.** [On the Development and Organization of Agricultural Entomology in Germany.]—*Arb. physiol. angew. Ent. Berl.* **3** nos. 2 & 4 pp. 156–160, 294–300. Berlin, 4th May & 10th December 1936.

A brief account is given of the origin and development of organised work on agricultural entomology in Germany, with notes on the establishment of research institutes with branch laboratories and field stations. The first regulation was issued in 1873 against *Phylloxera* [*vitifoliae*, Fitch] on vines, and the regulation of 1875 against the potato beetle [*Leptinotarsa decemlineata*, Say] is still valid. Reference is also made to entomological work done in the former German colonies.

Pawłowicz (J.). **Beobachtungen über einige in** *Porthetria dispar* **L.,** *Malacosoma neustria* **L. und** *Stilpnotia salicis* **L. (Lep.) schmarotzende Hymenopteren und Dipteren.** [Observations on some Hymenoptera and Diptera parasitising *P. dispar*, *M. neustria* and *S. salicis*.]—*Zool. Polon.* **1** no. 2 pp. 99-118, 1 graph, 56 refs. Lwow, 1936.

Records are given of the parasites and hyperparasites bred from larvae and pupae of *Porthetria dispar*. L., *Malacosoma neustria*, L., and *Stilpnotia salicis*, L., collected near Warsaw. In the following lists the figures in brackets show the percentage of parasitism. The parasites of *P. dispar* were *Apanteles solitarius*, Ratz. (17·5), *Tachina* (*Larvivora*) *larvarum*, L. (5·4), *Pimpla instigator*, F. (2·4), *A. vitripennis*, Hal. (1·7), *Zenillia* (*Carcelia*) *separata*, Rond. (1), *Sturmia scutellata*, R.-D. (0·4), and *Lydella nigripes*, Fall. (0·4) ; those of *M. neustria* were *T. larvarum* (10), *A. rubripes*, Hal. (8·4), *Pimpla inquisitor*, Scop. (2·7), *L. nigripes* (1·5), *Psychophagus omnivorus*, Wlk. (1·2), *Pales pavida*, Mg. (0·3) and *Meteorus versicolor*, Wesm. (0·3) ; and those of *S. salicis* were *T. larvarum* (74·6), *A. solitarius* (5·5), *Agria affinis*, Fall. (2·5), *M. versicolor* (1·7) and *Rhogas pallidator*, Thnb. (1·5).

Hyperparasites were obtained from all the Braconids and some of the Tachinids. *R. pallidator* was parasitised by *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.) (40) ; *A. solitarius* by *Hemiteles* sp. (0·9), *Pezomachus* sp. (1·8), *Mesochorus temporalis*, Thoms. (0·9), *Eurytoma appendigaster*, Swed. (0·9), *Eupelmella vesicularis*, Retz. (0·9), *D. cavus* (36·4) and *Habrocytus microgasteris*, Kurd. (3·6) ; *A. rubripes* by *D. cavus* (27·9) and *Habrocytus* sp. (0·7) ; *A. vitripennis* by *Phygadeuon monodon*, Thoms. (11·0) and *D. cavus* (22·2) ; *M. versicolor* by *D. cavus* (13·3) ; *T. larvarum* by *D. cavus* (3·3) and *Psychophagus omnivorus* (0·6) ; and *L. nigripes* and *Z. separata* by *D. cavus* (36 and 20).

[Romanova (V.).] **Романова (В.). On the Character of Injury caused to Wheat Grain by the Mites** *Tyroglyphus farinae* **L., and** *T. putrescentiae* **Schr.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 20–38, 7 figs., 9 refs. Leningrad, 1936. (With a Summary in English.)

An account is given of laboratory investigations carried out in the northern Caucasus in the autumn of 1934 and again in January–May 1935 on the infestation of stored wheat by *Tyroglyphus farinae*, DeG. (flour mite) and *T.* (*Tyrophagus*) *putrescentiae*, Schr. (elongate mite).

Examinations showed that under conditions of normal storage in granaries, with grain having a humidity of 14–17 per cent., the mites invariably attacked the germ, being thus especially harmful to seed wheat. They usually ate out the germ completely and then abandoned the grain without touching the endosperm. The endosperm was only attacked if it was softened, owing to the moisture content of the grain being 18 per cent. or more, in which case the grain was usually mouldy. The presence of mites in the germ is almost impossible to detect by examining the grain externally, owing to the minuteness of the cracks through which they penetrate.

It was found that the mites only attack wheat grains that have been injured in some way, though it has previously been stated that whole grains are also infested [*cf. R.A.E.*, A **24** 591]. In a series of experiments with *T. farinae*, the mites never attacked grains of which the seed-coat was intact, even under conditions of optimum humidity ; and when damaged and whole grains of different moisture contents were mixed, the damaged grains were always selected, even if they were drier. When infested wheat contained only a small percentage of injured grains, the mites concentrated in them and their development was retarded owing to overcrowding.

On the basis of these observations, the author concludes that any handling of the grain that tends to injure the seed-coat renders it liable to infestation by mites. The effectiveness of mechanical means of controlling the latter, such as passing the grain through cleaning machines, separators, etc. [*cf.* **23** 78 ; **24** 591], which involve an increase in the number of damaged grains, should, therefore, be carefully studied, and the grain treated in this way should be repeatedly examined for the presence of mites. To prevent infestation, it is recommended to use such measures as fumigating the granaries and the grain, drying the latter before storing, thorough cleaning of the granaries, and killing the mites by heat.

[Sazonov (P. V.).] **Сазонов (П. В.). The technical Effectiveness of Vapodust Preparations.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 54–65. Leningrad, 1936. (With a Summary in English.)

In experiments in 1934 the effectiveness of calcium arsenate dust was increased by impregnating it with mineral oils, of which spindle oil was the best. Field tests were therefore carried out in the Crimea between 11th May and 7th June 1935, in which calcium arsenate, alone or mixed with spindle oil, was applied to barley infested with larvae of *Lema melanopa*, L. The technique of preparing the mixtures is described ; they contained 5, 10, 15 or 20 per cent. by weight of spindle oil and were applied at rates varying from about 4 to 14 lb. per acre. The results were estimated on the third and fifth day after dusting by counting the dead and live larvae on sample plants taken along two diagonals in each plot. In all the tests in which the plants were dry, the oil increased the effectiveness of the dust and permitted a reduction in the amount applied per acre, about 10 lb. calcium arsenate alone being required to kill 91·5 per cent. of the larvae, whereas 96·1, 95·2 and 99·4 per cent. were killed by dusts containing 5, 10 and 15 per cent. oil, though the rates of application were only 6·3, 5·8 and 6 lb. per acre, respectively. When the plants were covered with dew, however, the effectiveness of calcium arsenate used alone increased (89·4 per cent. mortality with only 6·5 lb. per acre), whereas the

toxicity of the dust with 5 per cent. oil was not affected, and that of the dust with 15 per cent. was considerably decreased (80·6 per cent. mortality with 7·2 lb. per acre). In another experiment, in which the plants were dusted immediately after a heavy rain and during the fall of the dew, pure calcium arsenate was more effective than dusts with 10 or 15 per cent. oil, but less so than the dust with 5 per cent.

It is therefore recommended to use dusts containing 5 per cent. spindle oil, and always in the absence of dew, especially as in this way scorching is minimised.

[Éĭdel'man (Z. M.) & Novikova (N. G.).] **Эйдельман (З. М.) и Новикова (Н. Г.). Test for Determination of Mineral Oil in the Tissues of Plants sprayed with Emulsions.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 66–73, 5 figs., 6 refs. Leningrad, 1936. (With a Summary in English.)

Apple leaves were sprayed at 50°C. [122°F.] with 3 per cent. emulsions of mineral oils with viscosities of 1·5 and 6·1° Engler, and the spread of the oil in the tissues was studied by a staining technique, which is described. Two hours after spraying, the oil occurred in the intercellular spaces of the parenchyma as well as in the cells of the upper and lower epidermis, which showed that it penetrated not only through the stomata, but also directly through the cuticle of the upper and lower surfaces of the leaf. The light oil disappeared from the intercellular spaces much more quickly than the heavy oil; droplets of the latter also remained for a long time localised in the epidermis cells. In the leaves sprayed with the oil of low viscosity, the gas exchange in photosynthesis was more rapidly restored than in those sprayed with the oil of high viscosity [*cf. R.A.E.*, A **24** 705].

Investigations on the progress of the oil in the tissues of the leaves showed that its penetration from the intercellular spaces into the conductive system depends on its concentration in the emulsion [*cf.* **20** 59]. No particles of oil were detected in the phloem or xylem of the stalk, of leaves sprayed with a 3 per cent. emulsion of light oil, or in the veins of leaves sprayed with a 2 per cent. emulsion, the oil being localised in the epidermis of the stalk, the collenchyma and partly in the intercellular spaces of the peripheral parenchyma; whereas if the concentration of the oil in the emulsion was increased to 6 per cent., single oil droplets occurred in the phloem, woody cells and porous vessels of the veins on the fifth day after spraying. Experiments with downy and smooth apple leaves demonstrated that the morphological peculiarities of different varieties are of great importance in the penetration of the oils, since the hairs condense on their surface minute particles of oil and partly hinder the latter from passing into the tissues.

[Vel'tishchev (P. A.).] **Вельтищев (П. А.). Die Rolle der Naphtha-Oele bei der Bekämpfung der Ameisen.** [The Rôle of Petroleum Oils in the Control of Ants.] [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 74–80, 15 refs. Leningrad, 1936. (With a Summary in German.)

Ants cause considerable damage in the Russian Union to freshly sown seeds and seedlings of various plants [*cf. R.A.E.*, A **16** 667; **24** 707]. In experiments in Azerbaijan in 1935, stock emulsions

prepared from three types of residues of crude oil mixed with sodium salts of naphthene acids and of sulphoacids, and water, were diluted to concentrations of from 1 to 10 per cent. and used to flood the nests of various ants, from 9 to 35 fl. oz. of the diluted emulsion being applied to a nest. Examination 3-5 days after flooding showed that in most cases 5 or 10 per cent. emulsions killed all the ants in all galleries. The best results with emulsions of all concentrations were obtained by applying 18 fl. oz. per nest of a diluted stock emulsion containing 84·25 per cent. crude oil residue with a specific gravity of 1·01, 1·12 per cent. sodium salt of naphthene acids, 6·75 per cent. sodium salt of sulphoacids, and 7·88 per cent. water. With the addition of 0·5 per cent. sodium arsenite, even a 2 per cent. emulsion killed all the ants.

[Bryantzev (B. A.), Dobrozrakova (T. L.), Znamenskaya (M. K.) & Masaĭtis (A. I.).] **Брянцев (Б. А.), Доброзракова (Т. Л.), Знаменская (М. К.) и Масайтис (А. И.). Bitum, as a new Remedy in the Control of the Pest and Diseases of Vegetable Crops.** [*In Russian.*]—*Plant. Prot.* 1936 fasc. 8 pp. 88–98. Leningrad, 1936.

An account is given of field experiments carried out in June 1934 near Leningrad and in the Kola Peninsula on the application against the cabbage fly [*Phorbia brassicae*, Bch.] of a prepared emulsion containing 50 per cent. bitumen. This is a hard, chemically inert naphtha tar, which softens at 36–41°C. [96·8–105·8°F.], dissolves well in kerosene or benzene, is not poisonous, and does not injure plants. When the emulsion was diluted with 3 parts water and applied with a watering can to the soil at the base of cauliflower seedlings at the rate of 6–10 cc. per plant, a rather thick layer of bitumen was formed on the soil and prevented most of the young larvae from penetrating into the roots. As a result, 44 per cent. more plants were free from infestation in the treated beds as compared with the controls, and the percentage severely injured was 4 as compared with 21. When, however, the emulsion was applied to the soil by spraying, or directly to the roots of the seedlings by immersing them prior to planting, infestation was not prevented, probably because the crust of bitumen formed was too thin to prevent the larvae from penetrating.

[Chugunin (Ya. V.).] **Чугунин (Я. В.). Results of Acclimatisation of *Aphelinus mali* Hald. in the Crimea.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 99–103. Leningrad, 1936.

The woolly aphis [*Eriosoma lanigerum*, Hsm.] is abundant on apple in all the fruit-growing districts in the Crimea and is especially injurious in the south. Mass-breeding of its parasite, *Aphelinus mali*, Hald., (which had been successfully established in the Crimea in 1931 [*cf. R.A.E.*, A **21** 633]) was undertaken in the autumn of 1933. In the second half of March 1934, twigs bearing parasitised Aphids were fastened to the northern side of two or three trees in every acre of a number of orchards over an area of 7,800 acres in southern Crimea. The parasites began to emerge at the end of April, and 8 generations were produced during the summer. In August they were found to have spread over an area of 14,800 acres, being present wherever *E. lanigerum* occurred, and in half of the orchards examined had decreased its numbers by 70–80 per cent.

[Kivit (O.).] **Кивит (О.). The Acclimatisation of** *Aphelinus mali* **Hald. in the North Caucasus.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 104–108. Leningrad, 1936.

Details are given of the successful establishment of *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] in the south-eastern part of the North Caucasus in 1933. The parasites were released on heavily infested apple trees at 5 different points about 600 yards apart. Between 23rd April and 17th November, 8 complete generations were produced, some of the larvae of the eighth generation and all those of the ninth hibernating [*cf. R.A.E.*, A **23** 576]. By the end of July, 80–100 per cent. of the Aphids were parasitised in some orchards, and the parasite had spread over an area of 500 acres. It survived temperatures as low as —21 and —25°C. [—5·8 and —13°F.] in November and December and reappeared on 23rd April 1934. In the summer of that year colonies of the Aphid were very scarce, its increase having been checked by the parasite. In 1935 *A. mali* was introduced into Daghestan, where it had produced a parasitism of 60–70 per cent. by mid-July and was spreading.

[Mishchenko (A. I.).] **Мищенко (А. И.). The Crane Fly** *Tipula conjugata* **Alex. as a Pest of Rice in the Far East Region.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 143–147, 3 figs., 4 refs. Leningrad, 1936. (With a Summary in English.)

Considerable damage to rice in the southern part of the Russian Far East is caused by *Tipula conjugata*, Alex., all stages of which are described. Early in June, the overwintered larvae migrate to the rice-fields from adjoining peat bogs overgrown with *Glyceria*, etc. They are most numerous in the part of the field that is closest to the bog. If the water covering the rice-field is 4 ins. deep or more, the larvae abandon the mud in which they are usually partly buried, and float on the surface of the water, trying to escape to shallower places. The larvae eat through the rootlets and stems of the young rice plants, chiefly at night and in dull weather. The plants then float on the water and are driven by the wind to the borders of the plots, as many as 80–100 per cent. being sometimes destroyed. In 24 hours in the laboratory, one larva ate about 4 ins. of clean rice roots, or about 2 ins. of roots covered with earth and decaying vegetable matter. The larvae feed till the second half of August, when they begin to concentrate in the soil of the ridges that separate the plots, or make their way to places in the adjoining peat bogs that are not covered with water. Observations showed that the larvae can live for up to 22 hours in water without any air or for 8–10 days in dry soil. Pupation begins about the middle of September at a depth of 1–1½ ins.; if the soil is covered with a layer of decaying vegetable matter, the thorax of the pupa protrudes from it. The pupal stage lasts 10–12 days, and the adults begin to pair soon after emergence and lay eggs on or just below the surface of the soil. One female lays 250–450 eggs. The larvae hatch in 4–5 days and enter the soil for hibernation in the first half of October.

The application to the infested rice-fields of sodium arsenate or tobacco extract, at initial dosages of 1 oz. and 4 oz., respectively, in 25 gals. water, killed 87–98 per cent. of the larvae, and practically freed the plots from infestation. The best method, however, is drainage of swampy places near the rice-fields.

[Stark (V. N.).] **Старк (В. Н.). A Revision of the Bark-beetles of the Genus *Hylesinus* found in USSR.** [*In Russian.*]—*Plant. Prot.* 1936 fasc. 8 pp. 148–153, 19 refs. Leningrad, 1936.

A key is given to the 15 species of *Hylesinus* that occur in the Russian Union, with notes on their distribution. They include 3 new species, all of which are described in English, from ash (*Fraxinus*), *viz.*, *Hylesinus pravdini* and *H. lubarski* in the Ussuri district of the Russian Far East, and *H. tupolevi* in the west of the Kirghiz Republic in Central Asia. *H. fraxini*, Panz., has recently become widely distributed in European Russia and causes serious injury to ash, especially in low-lying places.

[Voloshchuk (V. M.).] **Волощук (В. М.). Mites found in stored Grain in the Crimea.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 154–156. Leningrad, 1936. (With a Summary in English.)

Very brief notes are given on the distribution, seasonal occurrence, abundance and economic importance of 26 species of mites found in the Crimea in granaries and in cultivated fields on cereals, stubble, straw or in the soil. Most of the damage to all kinds of stored grain is caused by *Tyroglyphus farinae*, DeG., *T.* (*Tyrophagus*) *putrescentiae*, Schr., and *Glycyphagus cadaverum*, Schr., all of which are very abundant and occur over the whole of the Crimea. The two species of *Tyroglyphus* are also found in wheat seeds in the soil. *Rhizoglyphus echinopus*, F. & R., which is usually a pest of roots and bulbs, was found infesting stored cereals, especially if they had a moisture content of 16 per cent. or more ; it hollowed out grains of wheat and maize and also occurred in wheat seeds in the soil. *Tyroglyphus* (*Tyrophagus*) *bülleri*, sp. n., which is briefly described, occurred from March to September in granaries containing wheat and maize, and in the soil in wheat seeds ; single individuals were taken on ears of wheat in the field. The predatory mites, *Cheyletus* sp. and *C. eruditus*, Schr., are widely distributed both in granaries and in the field, being very resistant to sharp fluctuations in temperature. Though they prey on other mites, they also contribute to the heating of the grain and pollute it with their excreta, skins, etc.

[Maslovskiĭ (N.).] **Масловский (Н.). *Chilocorus rubidus* Hope a new Predator of the Scale Insects.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 157–158. Leningrad, 1936.

Descriptions are given of the larva and adult of the Coccinellid, *Chilocorus rubidus*, Hope, which is predacious on *Lecanium corni*, Bch., in the Ussuri region of the Russian Far East. Observations of its activity and the fact that other species of its genus feed on Diaspine Coccids suggested that it might be utilised against the Californian scale [*Aonidiella perniciosa*, Comst.] in the Caucasus, and other parts of Russia [*cf. R.A.E.*, A **25** 149].

[Lugovikov (L. A.).] **Луговиков (Л. А.). On the Biology of *Pachnephorus tessellatus* var. *sabulosum* Gebl.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 159–162, 1 ref. Leningrad, 1936.

Following outbreaks of the Eumolpid, *Pachnephorus tessellatus* var. *sabulosus*, Gebl., in the Altaĭ region of south-western Siberia in 1925 and

1926 [*R.A.E.*, A **15** 158], a study of its bionomics was carried out in 1927–29. All stages are described. There is one generation a year, the overwintered adults appearing on the surface of the soil early in the spring, but the hibernation quarters have not been ascertained. The beetles were abundant till mid-June, but disappeared during the following month. They were most active on warm windless days, when the temperature of the soil surface was 22–30°C. [71·7–86°F.]; at 35°C. [95°F.] they sheltered under lumps of earth or in shady places, and at 54°C. [129·2°F.] abandoned the hot soil and climbed on to plants. The eggs were laid in the upper layer of the soil, usually singly, the maximum number deposited by a female in the insectary being 17. The egg, larval and pupal stages occupied 9–15, 40–50 and 10–12 days, respectively. In nature, mature larvae were found in July, at a depth of 2–10 ins. in the soil, at the edges of a wheat field or just outside it in ground overgrown with *Artemisia maritima*. They appear to be of no economic importance. Pupae were found in the soil at a depth of about 10 ins., and the young adults began to emerge on 24th July and were abundant between 4th August and 15th September. They chiefly occurred on the borders of wheat fields and in fallow land covered with *Artemisia*, on which they fed.

The beetles caused little damage to wheat in 1927 and 1928 and did not affect the yield of the crop. Oats and sunflowers were practically uninjured, except in one instance in which a ½-acre strip of sunflowers was completely destroyed.

[Ugryumov (G. D.).] **Угрюмов (Г. Д.). On the Technique of the Use of Cyanide Compounds for Disinsection.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 162–165. Leningrad, 1936.

Methods of improving the technique of using calcium cyanide to fumigate cotton-seed against pests were studied in Central Asia in 1935. The calcium cyanide powder used contained 20–21 per cent. cyanide, 45–49 per cent. calcium oxide, 2·2–6·1 per cent. iron oxide and aluminium oxide, 0·6–1 per cent. silicic acid and 15–22 per cent. chlorine. It was found that when high dosages of calcium cyanide are used, it is essential to introduce carbon dioxide to secure complete release of the cyanide. Thus, in large jars at 10–12°C. [50–53·6°F.] with a dosage of calcium cyanide equivalent to 4 oz. per 10 cu. ft., only traces of cyanide remained unreleased in the powder after 24 hours, if the carbon dioxide content was 5 per cent., whereas as much as 16·9 and 7·5 per cent. remained after 24 and 28 hours, respectively, if the carbon dioxide content was 3 per cent. When carbon dioxide is not available or there is not enough floor surface on which to spread a sufficient amount of calcium cyanide, the use of sulphuric acid to decompose the cyanide is recommended. Experiments showed that the optimum proportions were 10 parts calcium cyanide, 6 parts sulphuric acid (52° Bé) and 10 parts water. Good results were also obtained with 1 part hydrochloric acid in 3 parts water, provided that 10–15 parts diluted acid were taken to 1 part calcium cyanide.

[Sidel'nik (I.).] **Сидельник (И.). The Insect Pests of *Perilla* in Ukrainian SSR.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 169–171. Leningrad, 1936.

In 1934, observations were made in the Ukraine on pests of *Perilla*, the cultivation of which has recently been started, as it produces a

valuable oil. From 1·2 to 61·3 per cent. of the sprouting plants were attacked in spring by the adults of *Opatrum sabulosum*, L., and in about half of these the stem was severed or the growing point destroyed. The infestation was most severe in plots sown as late as the second half of April; those sown at the beginning of the month were only slightly attacked. In August, at the time of flowering, a mite of the genus *Tetranychus* (*Epitetranychus*) attacked the leaves, chiefly the lower ones. It was much more abundant on plants sown on 6th or 11th April than on those sown on 4th or 28th April. A few flowering plants were attacked by the larvae of *Amphimallus solstitialis*, L., which gnawed off the bark on the underground part of the stem, causing the leaves to turn purple and wither.

The mite was successfully controlled by hand dusting with a mixture of 9 parts road dust and 1 part crude anthracene, which is a by-product of the coke-benzene industry and has the appearance of slightly damp sand, giving off a smell similar to that of naphthalene [*cf. R.A.E.*, B **22** 195]. Applied at the rate of 18 lb. to the acre, the dust considerably decreased the numbers of the mites on the plants 5 days after treatment, and on the 10th day only 28 per cent. of the leaves examined harboured mites, whereas all those on the untreated plants were infested.

[Parfent'ev (F.).] **Парфентьев (Ф.). New Data on** *Codiosoma spadix* **Hb. and** *Nacerda melanura* **L.** [*In Russian.*]—*Plant Prot.* 1936 fasc. 8 pp. 171–174, 2 refs. Leningrad, 1936.

In the last ten years, *Codiosoma spadix*, Hbst., and the Oedemerid, *Nacerda melanura*, L., have greatly increased in numbers in Leningrad, becoming serious pests of woodwork in inhabited buildings. In 1934, *C. spadix* was common in stone houses, boring in the outer layers of the sap-wood in timber that was damp. The ends of beams were sometimes reduced to a spongy mass, and the infested edges of planks in the flooring broke off. The larval galleries intertwine with those of the adult weevils, and the attacked parts are easily detected by their brownish colour. Preference is shown for old wood, having a moisture content of 30–70 per cent.; the dry parts are only infested under crowded conditions. Drying the wood may, therefore, assist in control. Hibernation takes place in the larval and adult stages, and the weevils of the new generation appear in June–July. The infestation spreads from one storey to another, as the weevils migrate to new quarters through chinks in the floor and ceiling, and by crawling on the outside of the walls. Under certain conditions of humidity, *C. spadix* occurs together with *Anobium punctatum*, DeG., and between them they rapidly render unsound the wooden parts of houses.

N. melanura was found in basements, attacking the planks of the underflooring and beams in the part that adjoined the soil. In all cases, the timber was partly decayed and infected with fungi. The larvae tunnel inside the wood, and, as a result of the infestation, the underflooring rapidly falls to pieces and the upper flooring sinks. The adults are in flight at the end of June and in July, and lay eggs in batches of 3–15; the larvae hibernate. The increased infestation in Leningrad is probably a result of the flood in 1924, when cellars and basements remained under water for a considerable time, so that the damp timber subsequently offered favourable conditions for the development of fungi and of the beetle.

Summary of the Scientific Research Work of the Institute of Plant Protection for the Year 1935. [*In Russian.*]—Roy. 8vo, 596 pp., illus. Leningrad, Lenin Acad. agric. Sci., 1936. Price 12 *rub.*

This summary comprises a large number of papers by various authors, those that deal with different aspects of a particular general problem being grouped together. The following are those of entomological interest, together with brief summaries of their contents.

Shchegolev (V. N.). **Ecologo-economic Zonation of the USSR Territory in Relation to agricultural Pests and Diseases of Plants** (pp. 11–13). It is important to ascertain the distribution in the Russian Union of the different pests and diseases attacking cultivated plants, and the areas in which they are injurious. Studies of the ecology of individual species enable the causes that govern their distribution to be determined.

Predtechenskiĭ (S. A.). **The geographical Distribution and Zones of economic Importance of the Migratory Locust** (*Locusta migratoria* **L.) in USSR** (pp. 13–15). Beĭ-Bienko (G. Ya.). **The geographical Distribution and Zones of economic importance of the Moroccan Locust** (*Dociostaurus moroccanus* **Thnb.) in USSR** (pp. 16–20). These two papers contain information similar to that already noticed [*R.A.E.*, A **24** 759].

Chetuirkina (I.). **The geographical Distribution and Zones of economic Importance of the Italian Locust** (*Calliptamus italicus* **L.) in Kazakhstan** (pp. 20–22). *C. italicus* is widely distributed and injurious in Kazakstan. In the east it is closely associated with *Artemisia* spp., but in the semi-desert zone it occurs in almost all types of plant communities. In the European part of the Russian Union, it is injurious in the steppes.

Ya[roslavtzev] (G. M.). **Economic and ecological Zonation of Wireworms (Elateridae) in USSR** (pp. 23–27). In European Russia, wireworms are most abundant in the central belt of the country, especially in the west and in the steppe regions of the central Volga. In Asiatic Russia, they cause serious injury in western Siberia and Central Asia. Infestation is heaviest in cultivated fields and is in direct proportion to the prevalence of weeds. *Corymbites* (*Selatosomus*) *aeneus*, L., and *Limonius aeruginosus*, Ol., chiefly occur in sandy and light clay soils; *C. sjaelandicus*, Müll., is confined to swampy peat soils; and *Agriotes sputator*, L., which is especially abundant in the Volga region, infests a great variety of soils and withstands a wide range of humidity.

Berezina (V. M.) & Stark (V. N.). **Zonation of** *Melolontha hippocastani* **F. in USSR** (pp. 28–32). *M. hippocastani* is widely distributed under greatly varying climatic conditions and in different types of soil. In Asiatic Russia, it occurs in Siberia as far east as the Transbaikal region, where it is represented by the local variety *baicalica*, Reitt. In the northern and central parts of European Russia, the life-cycle requires 5 years, and the larvae are most abundant in the soil of open spaces in forests. Further south, in the Ukraine and parts of the Voronezh and Kuĭbuishev areas, the life-cycle is completed in 4 years, and the larvae are found in forests under the cover of trees, provided that the soil is dry and sandy. The beetle does not occur in the Crimea or the Caucasus, probably owing to the absence of forests.

Nikitin (I. V.). **Zonation of *Agrotis segetum* Schiff.** (pp. 32–33). The distribution of *Euxoa* (*Agrotis*) *segetum*, Schiff., in European Russia extends approximately from the south part of the Department of Vologda in the north to the Department of Samara in the south, and from Smolensk in the west to Perm in the east. The chief injury is caused in the north-eastern part of this area.

Aristov (M. T.). **Distribution and Zones of Injury of the Codling Moth in USSR** (p. 38). The codling moth [*Cydia pomonella*, L.] is common in all parts of the Russian Union in which apples are cultivated. The injury it causes varies with climatic conditions ; in Central Asia it has 3–4 generations a year. The boundary between the zones with 1 and 2 generations a year is determined by the July isotherm of 20°C. [68°F.].

Aristov (M. T.) **Distribution and Zones of Injury of *Aporia crataegi* L.** (p. 39). The abundance of *A. crataegi* varies with the prevalence of its food-plants, which include *Sorbus aucuparia*, *Crataegus* and fruit trees, and also with climatic conditions and the degree of parasitism. In the south of Russia, it is checked by temperatures as high as 42–43°C. [107·6-109·4°F.], which cause sterility. On the other hand, outbreaks are usual in the belt of deciduous forests and the forest-steppe zone, where the precipitation during June and July is over 2·76 ins. This enables flowers to produce sufficient nectar, which, as well as water, is essential for the feeding and especially oviposition of the adults. The butterflies are on the wing in June and oviposit in the first half of July.

Printz (Ya. I.). **A Study of physical and biological Factors of Mass Outbreaks and Spread of Pests with a View to Forecasts of Mass Outbreaks** (pp. 46–48). Studies of the effect of meteorological factors and conditions of feeding on the development, mortality and fertility of insect pests will make it possible to forecast outbreaks and determine the time to apply control measures.

Printz (Ya. I.) & Bobinskaya (S. G.). **Influence of Humidity on the Movements of Wireworms and Survival of different Stages at different Degrees of Humidity of Soil** (pp. 48–51). In laboratory experiments, at the optimum temperature of 20°C. [68°F.], larvae of *Agriotes obscurus*, L., tended to concentrate in layers of soil with a moisture content of 50 per cent. or over, and the rate of mortality under these conditions was the lowest. They began to feed on green plants only when the soil humidity was less than 25 per cent. of saturation ; the occurrence of bare patches in fields of cereals is, therefore, more likely to be due to lack of soil humidity than to a concentration of wireworms. The pupae did not suffer a high rate of mortality at any humidity, but the pupal stage was shortest (averaging 15–16 days) at humidities of 30–50 per cent.

Kozhanchikov (I. V.), Mikhaĭlova, Rzhechitzkaya (I.) & Volodina (E.). **Physiological Grounds for the Diapause of Insects. Influence of the Food-plant on Development of *Agrotis segetum* Larvae** (pp. 51–52). Observations on metabolism in pupae of the cabbage butterfly [*Pieris brassicae*, L.] showed that in pupae in the state of diapause only hydrocarbons are oxidised, whereas in the active ones fats and albumen are also consumed. In experiments in which larvae of *Euxoa* (*Agrotis*) *segetum*, Schiff., were fed on different plants,

mortality was lowest on *Atriplex* and none survived on heather or *Spiraea*. The larvae were best nourished on *Atriplex* and *Artemisia*; those fed on potato were also in good condition, but contained less water than any others. The moths that resulted from larvae fed on *Atriplex* or *Artemisia* were the most fertile, laying over 2,000 eggs each, whereas those from larvae fed on potatoes were either sterile or only laid 200–300 eggs.

Levin (V. M.). **Comparative Cold-Resistance of preimaginal Stages of *Agrotis ypsilon* and *Agrotis exclamationis*** (pp. 53–54). Of eggs of *Agrotis ypsilon*, Hfn., 75–80 and 40 per cent. hatched after being kept for 20 hours at —11°C. [12·2°F.] and —17·35°C. [0·77°F.] respectively. Of newly hatched larvae exposed for 17 hours, all were killed at —15·5°C. [4·1°F.], about 50 per cent. survived at –11°C., and only a few died at —7·8°C. [17·96°F.] or —5°C. [23°F.]. Larvae that had ceased feeding could seldom withstand temperatures below —5°C., only single larvae surviving at –8°C. [17·6°F.]. In the case of *Feltia* (*Agrotis*) *exclamationis*, L., all eggs were killed in 20 hours at —17·35°C. and all survived at —11°C. The newly hatched larvae were not killed even by exposure for 20 hours to —17·35°C. Those that had ceased feeding withstood temperatures as low as –8°C., and in many instances survived at –11°C., if kept in test tubes without soil. Pupae of both species exhibited an approximately equal resistance to cold, surviving exposures for 17–20 hours at —11°C. without soil; all were killed, however, at —17·35°C. If placed in sand, no larvae or pupae of either species survived even at —3·9°C. [25°F.]. This was probably due to direct contact with the sand; under natural conditions the larvae pupate in specially constructed cells, so that they are partly insulated from the soil by air.

Kozhanchikov (I. V.). **Influence of Humidity on the Development of *Loxostege sticticalis*, L. and *Agrotis segetum* (Egg and Larvae)** (pp. 54–58). Lack of humidity had little effect on the development of the eggs of *L. sticticalis* at 15–32°C. [59–89·6°F.], only 33 per cent. of those kept at the optimum temperature of 24°C. [75·2°F.] and a humidity of 7 per cent. failing to hatch. The viability of the resultant larvae was, however, much reduced. At 30°C. [86°F.], larvae of the first instar only survived at a humidity of 90–100 per cent. Those of the second and following instars resisted lower humidities, some being able to develop at 45 per cent. In the case of the prepupal stage, optimum conditions occurred at 85 per cent. humidity, whereas complete mortality took place at 90–100 per cent. The duration of larval development was little affected by humidity, but pupation was retarded in the case of larvae reared at the lower humidities. The quantity of water contained in larvae about to pupate was of importance in determining pupation, since, in cases of protracted diapause and a great loss of water by the larvae, they did not pupate if humidity was low, whereas those that diapaused normally at low temperature pupated even under conditions of extreme dryness, provided that the temperature was suitable. Females from larvae reared at low humidity were usually sterile, or only laid 10–30 eggs each. When pupae were kept at a low humidity, the fertility of the females was also decreased, but to a smaller extent.

Eggs of *Euxoa* (*Agrotis*) *segetum*, Schiff., at the optimum temperature of about 25–28°C. [77–82·4°F.], were able to develop at humidities ranging from 6 to 100 per cent. Larvae of the first instar were very

susceptible to lack of humidity, 60 per cent. dying at the optimum temperature of 25°C. if the humidity was as low as 65 per cent. In subsequent instars the larvae were more resistant, but their development was retarded by low humidity. Under dry conditions, the rate of mortality was high in the second, third and fourth instars, but low in larvae that had survived this period. The fertility of the moths was markedly affected if the larvae had developed at low humidity. On the other hand, 100 per cent. humidity resulted in a high rate of mortality of the larvae and sterility of the females.

Larchenko (K.). **Influence of Temperature and Humidity on the Fat-body of *Loxostege sticticalis* L. and its Rôle in the Formation of Sex Cells** (pp. 58–59). Preliminary studies have shown a direct relation between the condition of the fat-body in the larvae of *L. sticticalis* and the number of eggs deposited by the resultant females. Increased egg production following supplementary feeding of the adults may be explained by a smaller expenditure of the fat-body, though new components are not formed. The presence of an abundant fat-body in the larvae and pupae may result in a large egg production even if the moths have no food and are only given water. Unfavourable conditions of temperature and humidity hinder the development of fat-body in the larvae.

Kozhanchikov (I. V.). **Influence of Temperature on the Development of the Larvae and Eggs of the European Corn Borer** (pp. 59–60). Laboratory experiments showed that eggs of the European corn borer [*Pyrausta nubilalis*, Hb.] are very resistant to temperature conditions, all hatching at temperatures ranging from 18 to 30°C. [64·4–86°F.]. Complete mortality only occurs at about 8–9°C. [46·4–48·2°F.] and 34–35°C. [93·2–95°F.]. The optimum temperature for the development of the larvae is 28–29°C. [82·4–83·2°F.], but the range of temperatures at which development can take place extends from 8 to 34°C. The pupae are very adaptable to different humidities, being able to develop under conditions of extreme dryness, the resultant females laying eggs that develop normally, though their number is rather decreased.

Printz (Ya. I.), Kosmachevskiĭ (A. S.) & Bobinskaya (S. G.). **Influence of Temperature and Humidity on the Development of *Melolontha melolontha*** (pp. 60–61). Field observations in the Department of Voronezh in May showed that the adults of *M. melolontha*, L., usually start to fly 10–15 minutes after sunset, and are on the wing for 30–40 minutes, provided that the air temperature is not below 11·5°C. [52·7°F.]. Oviposition is restricted to soils that are covered with grass and occur in forests of moderately dense trees or in young stands of pines. The duration of the development of the larvae depends on temperature and nutrition ; those fed on rootlets of pine at 19–20°C.[66·2–68°F.] complete the first instar in 40–50 days. The first-instar larvae are much less active than older ones and do not migrate from too dry or too moist layers of the soil, so that they are killed if the humidity is 10 or 90 per cent. In sand that would hold a maximum of 21·5 per cent. moisture, the optimum conditions for the first two instars were found to be 30–70 per cent. of saturation. Eggs kept without soil were all killed when the relative humidity was 90 per cent. or less, at temperatures ranging from 10 to 25°C. [50–77°F.]. In the sand they survived at 50–90 per cent. of saturation at almost as large a

temperature range, optimum conditions occurring at 18–20°C. [64·4–68°F.]. These moisture requirements may explain the fact that the eggs can be found at depths of 18–26 ins. First-instar larvae died in 20 hours at —4°C. [24·8°F.] and in 1½ hours at from —7 to —11°C. [19·4–11·2°F.]. They contain much water and little fat and are therefore not resistant to cold, which explains their migration to deep layers of the soil for the winter.

Printz (Ya. I.). **Influence of Temperature and Humidity on Development of** *Polychrosis botrana* **Sch.** (p. 62). In central Georgia, the minimum and maximum temperatures at which the eggs of the vine moth, *Polychrosis botrana*, Schiff., developed in the laboratory were 10 and 35°C. [50 and 95°F.], the optimum being 25–28°C. [77–82·4°F.]. The relative humidity at which the eggs survived ranged from 30 to 100 per cent., though high mortality occurred at 30–36 per cent. Pupation took place at temperatures of 12–34°C. [53·6–93·2°F.], and the optimum conditions for pupal development and adult emergence were 20–27°C. [68–80·6°F.] and 50–70 per cent. humidity. At 32°C. [89·6°F.] the pupae did not develop, and at 90–100 per cent. humidity they became infested with fungi and were killed. Field observations showed that temperature is the chief factor that checks a mass increase of the moth.

Beĭ-Bienko (G. Ya.). **The Structure and Dynamics of Biocenoses of Virgin and newly-cultivated Areas** (pp. 75–76). Preliminary investigations were carried out in the Departments of Orenburg and Vyatka from 1st June to 4th October 1935 to determine the complex of pests that might be dangerous in land brought under cultivation. The methods used included periodical sweeping, counts of the fauna of sample plots, and the examination of cultivated plants.

Beĭ-Bienko (G. Ya.), Grigor'eva (T. G.) & Chetuirkina (I. A.). **Characters of the Surface and Soil Fauna in the Steppe Biocenoses near Saverovka Village, Orenburg Province** (pp. 78–82). Collections in June–September showed that fallow land overgrown with *Agropyrum repens* or tall steppe grass harboured the greatest variety of insects, as well as a large number of the larvae of weevils and wireworms, of which *Corymbites* (*Selatosomus*) *latus*, F., predominated. These parts of the steppe may, therefore, be considered as a reservoir of pests. Wireworms were practically absent from virgin soil. Fields of wheat harboured various thrips, flea-beetles, Coccinellids, Aphids and larvae of *Trachea basilinea*, F.

Grigor'eva (T. G.). **Cereal Pests in Biocenoses of Virgin Steppes** (pp. 82–85). In the virgin steppes in the Department of Orenburg, the greatest variety of insects occurred on *Stipa* spp. and *Festuca sulcata*. Spring-sown wheat was attacked by *Mayetiola destructor*, Say, *Oscinella frit*, L., *Meromyza saltatrix*, L., and *Chaetocnema* spp. Of these, *M. destructor* also occurred in old fallow and virgin land, and *M. saltatrix* in plots covered with *Agropyrum repens*.

Durnovo (Z. P.), Mitrofanova (A. M.), Smol'govskaya (M. I.), Kiris (I. B.) & Kiris (D. I.). **Changes in the Fauna of Pests in the Podzol Zone (Kirov Region) in the Case of Virgin Soil going into Cultivation** (pp. 88–90). In the course of investigations on insect pests in cultivated and uncultivated felled areas in forests, some of which had been destroyed or badly damaged by fire, numerous

species were found thriving in different habitats, chiefly feeding on wild graminaceous plants. *Oscinella frit*, L., and *Meromyza* sp. concentrated in areas adjoining forests and those situated along a river, whereas other Diptera and Orthoptera predominated in the open spaces in the felled areas and in cultivated fields. Wireworms comprised over 13 species, of which *Agriotes lineatus*, L., and *Corymbites* (*Selatosomus*) *aeneus*, L., alone infested cultivated fields for more than two years after they were first ploughed. The number of the larvae of *Melolontha hippocastani*, L., in the soil decreased in proportion to the period that had elapsed since the felling of the forest.

Znamenskiĭ (A. V.). **Development of a System of Control Measures against Pests and Diseases of Grain Crops** (pp. 91–97). A planned system of control involves a combination of measures that supplement one another, and is only possible if the system of cultivation is itself well organised. It is essential to consider the peculiarities of the individual districts and of the types of farming concerned. A brief survey is given of an attempt to work out a practical system of control measures in a district in the Voronezh Region in 1935.

Pavlov (I. F.). **Pests of Agricultural Crops on the Territory of the Talovaia State Farm in 1935** (pp. 97–100). The Curculionid, *Eusomus ovulum*, Germ., was the only important pest observed on a large farm in the eastern part of the Voronezh Region in 1935 ; it destroyed up to 80 per cent. of the leaf-surface of beans [*Phaseolus*] in the beginning of June. Its abundance was probably due to the fact that such plants as sunflowers, peas and beet, which it attacks readily, are cultivated every year in the same fields ; it did not occur on another farm, where cereals were sown in 1934. Other pests were the wheat thrips [*Haplothrips tritici*, Kurdj.], *Oscinella frit*, L., and the root aphis, *Forda trivialis*, Pass., all on wheat ; and the pea aphis [*Macrosiphum onobrychis*, Boy.], which attacked peas near perennial leguminous crops.

Kirt (L. I.). **On the Location of Oviposition of *Agrotis segetum* Schiff.** (pp. 106–109). Observations between 16th August and 20th September 1935 in the Department of Kursk showed that *Euxoa* (*Agrotis*) *segetum*, Schiff., prefers to oviposit in fallow land where weeds are sparse and either trail on the ground or have leaves close to it. Eggs are laid in considerable numbers, however, on cereal stubble and some on sprouting cereals, but only before they have begun to tiller. In densely overgrown plots with a compact soil, the eggs are chiefly laid on plants, whereas if the soil is loose and there are comparatively few weeds, many are laid on dry vegetable matter. When laid on plants, the eggs are close to the ground.

Romanova (V.). **Study on the Vital Activity of Mites** (pp. 110–111). This is an abstract of information already noticed on mites infesting stored wheat [**25** 129].

Kreĭter (E. A.). **Establishment of Terms for Sowing and Vernalization in Connection with Infestation with Insect Pests concealed in Stalks** (pp. 129–131). Observations in the Voronezh Region in 1935 on wheat sown early (27th March), at the normal time (16th April) and late (8th May) confirmed previous experience that early sown spring cereals are less injured by *Oscinella frit*, L., than those sown late. In 1935 the flies appeared on 13th May, but injury was only caused from 30th May onwards. At the time of oviposition, wheat plants

sown in March and April had already tillered and were in the phase of tubing, having thus completed the stage of development in which they would be readily infested. In the late-sown field, the plants usually had one stem only.

Ostapetz (A. P.) & Makeeva (E. A.). **Importance of Terms for Cultivation of Fallow as to Cutworm (*Agrotis segetum* Schiff.) Control** (pp. 131–134). In the Voronezh Region, only the second generation of *Euxoa* (*Agrotis*) *segetum*, Schiff., is injurious, the larvae attacking cereals. In 1935, the adults of the first generation were on the wing from 26th July to 27th August, oviposition was observed on 16th August, and the first larvae appeared on 12th September. Three fallow fields were cultivated on different dates in August, the weeds being removed from them and burnt. In September, the number of larvae to a given area was four times as great in the field cultivated on 27th–28th August, just before sowing, as in that cultivated on 13th–14th August, and twice as great as in that cultivated on the 21st–22nd August, during the period of the mass flight.

Zhukovskiĭ (A.). **Noxiousness of *Oscinosoma frit* L. and other Pests of Summer Wheat in Connection with Sowing Terms and Vernalization** (pp. 157–160). Observations in Voronezh in 1935 on wheat sown at 4 different dates between 26th March and 29th April confirmed previous findings that injury to the main stem by *Oscinella* (*Oscinosoma*) *frit*, L., *Phorbia genitalis*, Schnabl, or *Chaetocnema aridula*, Gyll., either kills the plant or greatly reduces the yield [*cf. R.A.E.*, A **23** 613]. In the case of all dates of sowing, the plants that were well developed at the time of infestation were more readily attacked than the less developed ones. The best yield was obtained from the early sown wheat, whereas, owing to lack of rain in April–July, the wheat sown late gave a bad crop, though it was little infested by insects. The damage caused by *O. frit* increased with the proximity to the fields of autumn-sown wheat, all plants in plots adjoining the latter being infested, whereas at a distance of about 440–550 yards the infestation dropped to 10 per cent.

Karpova (A. I.). **Noxiousness of *Chlorops pumilionis* Bjerk. on Summer Cereals in 1935** (pp. 160–164). Data obtained from various districts in north-western and central European Russia on the degree of damage caused to summer cereals by *Chlorops taeniopus*, Mg. (*pumilionis*, Bjerk.) showed that the crop reduction is greater in barley than in wheat. Infestation of barley was less severe if it was sown late or in manured ground.

Selivanova (S.). **Noxiousness of *Laspeyresia dorsana* F.** (pp. 165–169). Peas sown in mid-April 1935 in a locality in the Voronezh Region were less infested by *Cydia* (*Laspeyresia*) *dorsana*, F., than those sown on 27th April ; the loss in the weight of crop from the latter was 3·95 per cent. The number of infested peas increased with the length of the period that elapsed between the harvest and the threshing ; in the case of peas sown on 21st April, the loss was 0·33, 1·36 and 7·96 per cent. in those threshed 5, 15 and 25 days after harvest, respectively.

Pavlov (I. F.). **Noxiousness of *Haplothrips tritici* Kurd.** (pp. 169–173). Investigations on the injury caused to winter and summer wheat by *Haplothrips tritici*, Kurdj. [*cf.* **23** 565] were carried out in the Voronezh Region. The upper part of the ears was less infested

than the middle or lower parts. Systematic counts of the larvae on summer wheat showed that they sometimes migrate from one part of the ear to another and from ear to ear, concentrating on the green ones at the period of ripening. By weighing individual grains infested with 1, 2, 3, 4 or 5 thrips, it was estimated that each thrips reduced the weight of a grain by about 1 mg.

KASIKHIN (A. N.). **Efficiency of Measures taken for Protection of Crops of Grain Rotation in Talov Region (Voronezh District)** (pp. 182–185). Investigations in 1935 showed that the cost of digging trap trenches (16 ins. deep and 10–14 ins. wide) round plantations of beet to safeguard them from the beet weevil [*Cleonus punctiventris*, Germ.] is not justified, unless the weevils are abundant. Hand-collection of the larvae of *Loxostege sticticalis*, L., repeated three times and supplemented by the use of a mechanical collector, proved to be the most reliable and effective method of reducing their numbers.

STARK (V. N.). **Development of the System of Measures for the Wood Zones protecting Fields** (pp. 186–189). In view of the progressing afforestation of the drought zone in the south-eastern part of European Russia, preliminary work has been carried out in the Region of Voronezh to elaborate a system of control measures against pests of the narrow protective strips of woodland that have been planted along cultivated fields in the steppes. The system should include a quarantine of nursery stock and seeds, removal of infested trees, improvement of silvicultural methods, and the application of chemical, mechanical and biological methods of control.

NIKOL'SKIĬ (V. L.). **Pests of the Rossoshansk Tree Nurseries** (pp. 189–192). As a result of the poor cultivation of the soil, a number of insect pests attacked the seedlings in a tree nursery in the south-western part of the Voronezh Region, about 16 per cent. of the plants being destroyed. Of those that damaged the roots, the most important were *Lethrus apterus*, Laxm., on cherries and apples, *Gryllotalpa gryllotalpa*, L., on willows and poplars, *Amphimallus solstitialis*, L., and *Opatrum sabulosum*, L., on maple, and *Euxoa* (*Feltia*) *segetum*, Schiff., on oak. The most injurious of the other species were *Aphis pomi*, DeG., on apple, *Myzus cerasi*, F., on cherry, and *Tortrix* (*Cacoecia*) *rosana*, L., on various fruit-trees.

KELUS (O. G.). **Pests and Diseases of young Field Protection Wood Zones of the Kamennaja Steppe and the Volga Districts** (pp. 192–196). The chief pests found in protective strips of young trees planted round fields in the Kamennaya Steppe in the region of Voronezh and in a locality in the Republic of the Volga Germans were the sawfly, *Trichiocampus ulmi*, L., on elm, the Meloid, *Lytta vesicatoria*, L., on ash, the Aphids, *Thecabius affinis*, Kalt., and *Pemphigus bursarius*, L. (*lactucarius*, Pass.), on poplars, the sawfly, *Pseudoclavellaria* (*Clavellaria*) *amerinae*, L., and the Chrysomelid, *Melasoma tremulae*, F., on willows, and the Pyralid, *Selebria marmorata*, Alph., on yellow acacia [*Caragana*].

GUSEV (V. I.). **Biological Survey of the Overground Pest Fauna of the Wood Zones in the Voronezh District** (pp. 196–199). Of more than 200 species of injurious insects observed in strips of oak, elm, ash and birch planted in a steppe in the south-eastern part of the Voronezh Region, the most abundant were the Noctuid, *Diphtera alpium*, Osbeck, and *Haltica saliceti*, Ws., on oak, *Dasychira pudibunda*, L.,

on oak, elm, maple, etc., *Heterogenea asella*, Schiff., on lime and maple, *Trochilium* (*Aegeria*) *apiforme*, Clerck, on poplar, *Curculio glandium*, Marsh., and *C. venosus*, Grav., which in many stands infested over 75 per cent. of the acorns, and *Agrilus* spp. on a variety of trees.

Mel'nichenko (A. N.). **The Importance of protective Strips of Woods for the Increase of Animals injurious or beneficial to Crops** (pp. 202–206). Investigations in the Kuĭbuishev (Samara) Region showed that, under favourable conditions of weather and nutrition, insects adapted to mesophyte conditions, such as the majority of the Coleoptera, Hymenoptera, Aphids, etc., concentrate in proximity to the protective strips of trees. On the other hand, insects adapted to xerophytic conditions, such as practically all Orthoptera, most of the Rhynchota and Halticids, occur at a distance from them. Since the insects of the latter type comprise the chief agricultural pests occurring in south-eastern Russia, the afforestation of this region is beneficial as a control measure. Moreover, the belts of woodland harbour insectivorous birds. In the case of some insects, however, they afford favourable conditions for hibernation ; *Phyllotreta vittula*, Redt., migrates to them in the autumn, and in spring infests cabbage and beet so severely that they have to be resown.

Berezina (V. M.). **Alteration in Biocoenoses of Soils in Connection with the Converting of Steppes into Forests** (pp. 207–211). Investigations in the south-east of the Voronezh Region showed that the insect fauna of the soil in plantations of elms 2–4 years old did not differ from that in fallow land and included larvae of *Amphimallus solstitialis*, L., *Agriotes sputator*, L., and *A. gurgistanus*, Fald. Strips of trees 6 years old, and especially those 8–9 years old, in which the crowns had already formed a canopy, harboured species that are invariably associated with forests, such as *Athous obscurus*, Payk. (*haemorrhoidalis*, F.), *Limonius minutus*, L., and *Serica brunnea*, L. This Melolonthid, which has been stated in the literature to complete its development in one year, appeared to have a two-year cycle with a well pronounced flight year.

Parfent'ev (V. Ya.). **Study of the specific Composition of Wood and Shrub Species used for Wood Zones protecting Fields and Establishment of Species that would safeguard agricultural Plantations against Pests** (pp. 211–215). Twenty-five species of insects injurious to orchards are recorded as developing on trees in protective forest strips in the Voronezh Region. Of these, the Noctuid, *Acronicta tridens*, Schiff., which has two generations a year and occurred on apple and cherry in an orchard adjoining infested strips of woodland, appears likely to be the most important. Other pests that were present in numbers in orchards and woods were the weevils, *Rhynchites bacchus*, L., *R. auratus*, Scop., *Polydrusus picus*, F., and *Phyllobius oblongus*, L. Elm, sloe [*Prunus spinosa*], *Crataegus oxyacantha* and dwarf almond were found to harbour the greatest number of orchard pests and should therefore be excluded from the plantations.

Kistyakovskiĭ (A. B.). **Economic Importance of the Avian Fauna of Forest Areas and experimental Attempts to utilize some Species** (pp. 215–216). Examinations of the stomach contents of birds that inhabit strips of woodland in the south-east of the Voronezh Region showed that from 12 to 50 per cent. of their food consisted of injurious

insects. Only a few species, such as rooks, magpies and sparrows, also caused considerable injury to crops. Nesting boxes should be placed in the woodland to increase the numbers of insectivorous birds, especially those that nest in hollow trees.

Nikol'skiĭ (V. V.), Galakhov (P. N.), Predtechenskiĭ (S. A.) & Letov (A. S.). **Ecologo-economic Basis and Development of a System of Control Measures against Pests and Diseases in the established Cotton-growing Districts (Uzbekistan)** (pp. 217–221). A systematic study of material from different parts of Turkmenistan, Tadzhikistan and Uzbekistan has shown that the mite occurring on cotton in Central Asia, which has often been recorded as *Tetranychus telarius*, L. (*althaeae*, v. Hanst.) [*cf.* **20** 619 ; **22** 440, etc.], is an undescribed species of *Tetranychus* (*Eotetranychus*). The characters distinguishing it from allied mites are indicated. In eastern Uzbekistan, it was also found on mulberry. A mortality of 79–82·5 per cent. was obtained by spraying cotton and weeds with lime-sulphur (0·5° Bé), provided that the temperature was not below 25°C. [77°F.], and all mites were killed on weeds surrounding the cotton fields by the application of alkali residues from the manufacture of soap. Outbreaks of the Moroccan locust [*Dociostaurus maroccanus*, Thnb.] and *Calliptamus italicus*, L., continue to occur in the cotton-growing areas in spite of control measures, which are rendered ineffective because it is not known where these locusts breed.

Rodd (A. E.). **Study on Control Measures against** *Chloridea obsoleta* (pp. 229–231). In field tests against the larvae of *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.) on tomatos and cotton in Uzbekistan, poisoned baits of ground oilcake proved more effective than various dusts. The percentage mortalities obtained on tomatos were 80 with a bait containing 1·4 per cent. sodium arsenite applied at the rate of 45 lb. per acre and 83·5 with one containing 5 per cent. calcium arsenate at the rate of 90 lb. On cotton, 100 and 81·4 per cent., respectively, of the larvae were killed by baits containing 6·2 and 5 per cent. calcium arsenate used at the rate of 36 lb. per acre.

Rodd (A. E.). **An Investigation on the Rôle of Parasites of Eggs and Larvae of** *Chloridea obsoleta* (pp. 232–233). A great decrease in the numbers of the fourth generation of the bollworm, *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.), in the district of Tashkent in 1935, was caused by an unidentified egg parasite, which destroyed 68·2 per cent. of the eggs. Under experimental conditions, a female was capable of parasitising up to 15 eggs of the bollworm in 24 hours, and deposited 1–7 eggs (all of which developed) in each egg of the host. The adults, which lived for up to 34 days when given sugar-syrup, also fed on the fluid contents of the eggs of the bollworm. In August, the life-cycle was completed in 11–15 days. Hibernation occurred in the host eggs. The larvae of *H. armigera* were parasitised by an unidentified Braconid, which destroyed 12·2 per cent. of the second generation and 94·4 per cent. of the third. It oviposited in larvae of the first and second instars, usually laying one egg in each, and the parasites emerged when the host larvae were almost full-fed and immediately spun cocoons on the leaves. Hibernation occurred in the cocoon. In the insectary, the females of the parasite lived for up to 14 days and parasitised up to 11 larvae in a day. In south-western Turkmenistan (Ashkhabad), *H. armigera* was largely controlled by *Microbracon* (*Habrobracon*) *simonovi*, Kok.

Ivanov (E. N.). **Bionomics and Ecology of the Moroccan Locust in Middle Asia** (pp. 233–234). The egg-pods of the Moroccan locust [*Dociostaurus maroccanus*, Thnb.], which are laid on rather bare patches in unploughed land with a slight cover of *Poa bulbosa* and *Carex hostii* [*cf.* **24** 596], vary greatly in length in different parts of Central Asia, which suggests that there are different subspecies or ecological races. During the hopper stage, a swarm covers a distance of 1,000–3,300 yards, travelling for up to 660 yards in 24 hours. Migration starts in the first days after hatching and continues in the direction initially adopted.

Zhukov (V. G.). **A Trial of Fluorine Preparations and of Effectiveness of Dung Baits for Control of** *Calliptamus turanicus* (pp. 234–235). In field experiments in May-June 1935 in western Uzbekistan, poisoned baits were applied against *Calliptamus turanicus*, Tarb., at the rate of 14·4 lb. per acre. The best results were obtained with baits made of 3 parts of dung and 1 part of cotton oilcake with the addition of 1 per cent. arsenic trioxide, which gave a mortality of 93 per cent. Since, however, baits of dung alone with 1 and 1·5 per cent. arsenic trioxide gave mortalities of 92·6 and 87·1 per cent. respectively, the oilcake may be omitted. Baits of oilcake containing sodium fluosilicate proved to be more effective than those containing sodium fluoride; with 5 and 8 oz. poison in 10 lb. bait, the respective percentage mortalities were 71·9 and 81·2 for the fluosilicate and 46 and 53·1 for the fluoride. In baits containing 3 parts of dung, however, sodium fluosilicate was less effective than sodium fluoride or arsenic trioxide.

Limoenkov (L. K.). **The Examination of technical Effectiveness of Sulphur Preparations for Control against Cobweb-mite in different geographical Points** (pp. 235–236). Nikolyuk. **Technical Effectiveness of Sulphur Preparations against Cobweb-mite** (p. 237). These two papers deal with field tests of various sulphur dusts against the red spider [*Tetranychus* sp.] on cotton in Central Asia. In both series the most effective was ground sulphur mixed with talc. The effectiveness of the dusts decreased in late summer, when the temperature fell below 25°C. [77°F.].

Reddis (A. K.). **The Inquiry on the Effectiveness of the System of Measures for Control of Cotton Pests and Diseases** (pp. 245–248). In Central Asia, the red spider [*Tetranychus* sp.] spreads to cotton from weeds growing in and near the fields. Investigations in widely separated districts showed that spraying the weeds with lime-sulphur or oil emulsions delays and reduces the infestation of the cotton and is of much more value in the control of the mite than the removal and destruction of the weeds.

Shchegolev (V. N.). **Ecologo-economic Foundation and Development of a Complex System of Measures for Protection of Hemp against Pests and Diseases in the Forest-Steppe Zone of the USSR** (pp. 249–255). Hemp [*Cannabis sativa*] is extensively cultivated in some districts in the forest-steppe zone of European Russia and is attacked by 75 species of insects, of which the most injurious, in descending order of importance, are *Pyrausta nubilalis*, Hb., *Psylliodes attenuata*, Koch, *Loxostege sticticalis*, L., *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.), *Plusia* (*Phytometra*) *gamma*, L., and *Phorodon humuli*, Schr. (*cannabis*, Das.). The system of control measures applied against *Pyrausta*

nubilalis has given very satisfactory results [**23** 566]. Of dusts tested against *Psylliodes attenuata* on sprouting hemp, the most effective was a mixture of equal parts of calcium arsenate and ashes (1 : 1) used at the rate of 13·5 lb. per acre, which killed 46·7 per cent. of the flea-beetles in 24 hours. The plants were not scorched. The addition of chalk reduced the toxicity of the arsenate.

Laduizhenskaya (L. A.). **Influence of Microclimate as affected by Hemp Stalk Distribution and Feeding Habits of Larvae on Survival of** *Pyrausta nubilalis* **Hb.** (pp. 255–256). Observations in the Department of Chernigov, in plots of hemp on undulating ground, showed that, irrespective of the situation of the plots, the rate of mortality of eggs of *P. nubilalis* did not exceed 10 per cent., whereas 91–94·5 per cent. of the young larvae did not survive, chiefly owing to the prevailing wet weather and strong winds. In laboratory experiments, first-instar larvae penetrated the stems of hemp with difficulty, the optimum conditions being found in the inflorescences (87·3–100 per cent. survival). In the field, most of the larvae were prevented by unfavourable weather from reaching the inflorescences; previous observations had shown that 77 per cent. of the eggs are laid on the lower and middle parts of the plant. It is suggested, therefore, that the commonly observed mortality of 70–80 per cent. of the larvae is mainly due to the distribution of the egg batches on the plants.

Popova (A. I.). **Ecologo-economic Foundation and Development of a System of Measures for Protection of Fruit Tree Plantations from** *Aspidiotus perniciosus* (pp. 257–261). In the Russian Union, *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., occurs in south-western Turkmenistan (Ashkhabad) and the Azov-Black Sea Region, and is very injurious in the coastal zone of the Black Sea, where it infests plums, apples, pears and peaches, killing many seedlings and reducing the market value of the fruit. It is not affected by such high temperatures as 35·2–46°C. [95·3–114·8°F.], and a frost of −32°C. [−25·6°F.] only caused about 93 per cent. mortality. In the spring, sharp fluctuations of temperature kill about 30 per cent. of the scales. Only three generations are produced in rainy years, but if the weather is dry a partial fourth occurs. A large percentage of the scales is destroyed by predators, which include *Chilocorus renipustulatus*, Scriba, and *C. bipustulatus*, L. An effective system of control measures has been evolved; it includes fumigation of nursery stock and fruit with hydrocyanic acid gas, and summer and winter spraying with oil emulsions.

Korchagin (V. N.). **Study of the Biology and Ecology of the San-José Scale in the Slavjansk Region of the Azov-Black Sea District and Development of Control Measures** (pp. 261–263). In the district of Slavyansk, which is the most northern limit of its distribution in the Russian Union, *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., has three generations a year. The mortality due to cold among the larvae hibernating on fruit trees in 1934–35 was about 50 per cent. of those on the lower parts of the trunks under a cover of snow and débris, and 92·7 per cent. of those in exposed situations. A winter spray of 4 per cent. lubricating oil emulsion applied 2–3 times afforded effective control, provided that the whole tree was covered with spray and the old bark and lichen had been removed from it. All scales on harvested

fruit were killed by fumigation with hydrocyanic acid gas, using 1·6 oz. sodium cyanide to 100 cu. ft. at a temperature of 15–20°C. [59–68°F.].

Strukova (M. P.). **Ecological Study of San-José Scale and Injuries caused in the Maikop Region of the Azov-Black Sea District** (pp. 263–266). In the Maikop district, *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., has two complete generations a year and a partial third. The best time for spraying with oil emulsions in summer is between 10th and 20th June against the crawlers of the first generation, and in the second half of August against those of the second.

Shteinberg (G. A.). **Hydrogen Sulphide as Fumigant in San-José Scale Control** (pp. 266–268). In laboratory experiments in the Maikop district, hydrogen sulphide proved effective for fumigating seedlings, slips and fruit infested with *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., if the dosage was high and the exposure short. Complete mortality was obtained in spring, summer and autumn at temperatures ranging from 13 to 29°C. [55·4–84·2°F.] by using a dosage of 32·5 oz. per 100 cu. ft. for 30 minutes, the plants being uninjured.

Telenga (N. A.) & Bogunova (M. V.). **Parasites and Predators of Scales and Aphids in the Far East District** (pp. 270–271). Investigations on natural enemies of Coccids and Aphids were made in the Ussuri region of the Russian Far East with a view to introducing them into the Caucasus. The larvae of the Coccinellid, *Chilocorus rubidus*, Hope, were found to destroy 40–90 per cent. of the adults of *Lecanium corni*, Bch. It had one generation a year, the life-cycle at 19–21°C. [66·2–69·8°F.] being completed in 53–58 days. The overwintered adults began to oviposit at the end of May. Another species of *Chilocorus*, the larvae of which destroyed 50–80 per cent. of *Lepidosaphes yanagicola*, Kuw., also had one generation a year, the life-cycle being completed in 41–44 days at 12–22°C. [53·6–71·6°F.]. The overwintered adults were ovipositing from about mid-June to the end of August. Experimentally, this Coccinellid readily attacked *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst. *Coccinella* (*Harmonia*) *axiridis*, Pall., was a common and active enemy of Aphids, particularly *Hyalopterus arundinis*, F. (*pruni*, F.). The adults abandoned their hibernation quarters in the second half of May at a temperature not below 10°C. [50°F.]. The life-cycle was completed in 27–30 days, and a partial second generation was produced in a year. An adult consumed an average of 30–45 Aphids in a day, and a larva 270–330 in the course of its development, which lasted 15 days.

Lesnikovskaya (A. Ya.). **Estimation of a System of Measures for Fruit Tree Protection from** *Aspidiotus perniciosus* (pp. 271–273). The application of a system of control measures against various pests and diseases of apples proved on the whole to be effective, as the yield of fruit in the treated orchard was 84 per cent. higher than in the control. A single spraying with Paris green against weevils was insufficient, owing to the protracted period of their emergence from hibernation. A spray of anabasine sulphate applied three times against *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., also failed to give control, as it did not kill the more mature scales. The best results were obtained by spraying with Paris green against the larvae of the second generation of the codling moth [*Cydia pomonella*, L.], as it reduced the infestation of the fruit by about 33 per cent.

Nevskiĭ (V. P.), Shaposhnikova (E. M.), Blyashke (M. F.) & Lebedev (M. V.). **Some Improvements in the System of Control Measures against Codling Moth** (pp. 274–277). In field experiments in Central Asia against the codling moth [*Cydia pomonella*, L.] on apple, the removal of old bark from the trees increased the yield of fruit by 11 per cent. In spraying experiments, 4 lb. lead arsenate, 4 lb. calcium arsenate or 1·5 lb. Paris green was used per 100 gals. water; their efficiency was in the order given. The best control was obtained by three sprays of lead arsenate against the first generation and two against the second.

Uspenskaya (N.). **Causes of Fluctuations in the Number of Codling Moth Population** (pp. 277–280). Investigations in Central Asia showed that the fertility of the codling moth [*Cydia pomonella*, L.] is not affected by differences in the nutrition of the adults. The larvae developed better, and a greater percentage of them survived, when there were 1–3 in an apple than when there were 4–7, but, in the latter case, the resultant adults laid considerably more eggs. Pupal weight depended on the amount of food consumed by the larva, but was not correlated with adult fertility. The rapidity of the development of the larvae and pupae, and the fertility of the adults, was found to depend directly on the quality of the food of the larvae, apple seeds and pulp together being the optimum food, and seeds alone better than pulp alone. Fertility also varied with the temperature at which the larvae and pupae developed, 20–25°C. [68–77°F.] being the optimum. During the flight period, the moths require moisture and are readily attracted to clean water containers placed in the crowns of the trees. The number of moths drowned in them was equal to that in water containing odorous substances, or in baits of yeast or molasses, and increased if 0·1 per cent. flour or 0·02 per cent. glue was added to the water. It was also found that almost all the larvae hibernate on the trees, and only 25 per cent. die during hibernation.

Malinin (M.). **On chemical Methods of Control of Apricot Pests in Middle Asia** (pp. 280–281). In field experiments in northern Tadzhikistan against *Rhynchites auratus* var. *ferganensis*, Nevsk., on apricot [*cf.* **17** 587], 85–100 per cent. of the weevils were killed by sprays of 6 lb. lead arsenate (containing 29·7 and 29·1 per cent. As_2O_5) or 3 lb. calcium arsenate (38 per cent. As_2O_5) in 100 gals. water. The toxicity of the two arsenates differed little, but both caused severe scorching of the leaves, the calcium arsenate being particularly injurious.

Lebedev (M. I.). **Study of poisoned Bands in the Control of Codling Moth** (pp. 281–282). In field tests of corrugated paper bands treated with chemicals against the codling moth [*Cydia pomonella*, L.] in Central Asia, the best results were given by bands treated with alpha naphthylamine or with 3 parts beta-naphthol dissolved in 4 parts lubricating oil heated for 2–3 hours up to 118°C. [244·4°F.]. These gave a 99-100 per cent. mortality of the larvae for 100 days. Since, however, the trees were slightly injured, a strip of cardboard should be placed between the band and the bark. Bands smeared with a 50 per cent. solution of naphthalene in lubricating oil killed 95 per cent. of the larvae, without injuring the trees.

Sinel'nikova (Z. S.). **Study of *Cemiostoma scitella* Zell. and of its Control** (pp. 282–284). *Leucoptera* (*Cemiostoma*) *scitella*, Zell., is a

common orchard pest in Central Asia, especially in Uzbekistan. The chief damage is caused to apples, the larvae mining in the leaves from early spring till autumn and causing them to wither and drop. There are four generations a year, the pupae of the fourth hibernating. In the laboratory, a female laid 30–85 eggs. Development was most rapid at 27–28°C. [80·6–82·4°F.], at which the egg, larval and pupal stages averaged 8·6, 13·1 and 9·7 days, respectively. In laboratory and field experiments, the adults were killed by various contact sprays, but good results against the larvae were only obtained with nicotine, and a spray containing 0·03 per cent. nicotine and 0·3 per cent. soap is recommended. Under conditions of normal infestation, it should be applied three times at weekly intervals, starting as soon as flowering is over. In cases of outbreaks, a fourth spray should be applied a month after the third, and a fifth a week later. The lower surface of the leaves should be chiefly wetted, as the eggs are deposited there, and the poison penetrates into the mines better than through the upper surface.

Sinel'nikova (Z. S.). **Investigation on the chemical Control Measures for Summer Generations of Woolly Apple Aphid** (pp. 284–285). In tests under field conditions of a number of insecticides against the woolly aphis [*Eriosoma lanigerum*, Hsm.] on apple in Central Asia, various sprays containing anabasine, tobacco extract or kerosene emulsion gave 90–98 per cent. mortality. The most effective consisted of 8 oz. 36 per cent. anabasine sulphate and 3 lb. soap or Petrov's "Contact" [**20** 199] in 100 gals. water. If the Aphids are abundant and infest the smallest twigs, the quantity of the spray used should be at least 11 gals. to each tree 16–20 ft. high.

Bezrukova (T. I.). **A Study of Toxicity of arsenical Poisons for *Rhynchites auratus* Scop. *ferganensis* Nevsk.** (pp. 289–290). Under laboratory conditions in Central Asia calcium arsenate and lead arsenate killed a high percentage of the apricot weevil, *Rhynchites auratus* var. *ferganensis*, Nevsk., when applied as dusts and a lower percentage when applied as sprays. They injured apricot trees so severely, however, that they are quite unsuitable for practical use.

Toshevikova (A. G.), Anisimova (V.) & Lubentzova (N.). **Action of Arsenates and of Lime-sulphur Decoction on Fruit Trees** (pp. 290–293). Field experiments in which arsenicals were applied to the leaves, branches, shoots or buds of apples and peaches showed that they penetrate into the tissues of any part of the plant, but eventually become concentrated in the leaves, which are scorched and drop. The shedding of the foliage reduces the amount of arsenic in the plant, and, in cases of slight scorching, appears to be a protective reaction of the tree against poisoning. In many instances, the trees recover in a month or more. Calcium arsenate causes scorching in wet areas, but not in dry ones. In the case of lead arsenate, on the contrary, rain decreases the degree of scorching. Apple trees are more resistant to the effect of poisons than peaches or apricots.

Meĭer (N. F.). **Ecological and economic Basis and Development of Methods for Utilization of Parasites and Predators in agricultural Pest Control** (pp. 295–296). In view of the successful results obtained in different parts of the Russian Union in 1935 by using *Trichogramma evanescens*, Westw., for the control of *Cydia pomonella*, L., *Pyrausta*

nubilalis, Hb., and *Euxoa segetum*, Schiff., it is suggested that special laboratories for the mass breeding of various parasites should be established.

Shchepetil'nikova (V. A.). **Influence of physical Factors on Mass Propagation of *Trichogramma evanescens* Westw. and its Application in Crimean Conditions** (pp. 297–299). In the laboratory, at a constant temperature of 25–27°C. [77–80·6°F.], *T. evanescens* completed its development in eggs of *Sitotroga cerealella*, Ol., in 11–14 days. The females lived for 1–3 days irrespective of the humidity, but laid an average of 26 eggs at 100 per cent. relative humidity as compared with 19·4 at 50–55 per cent. The release of *T. evanescens* at the rate of 2,000 or more parasites per tree in an apple orchard in the Crimea against the second generation of the codling moth [*Cydia pomonella*, L.] decreased the infestation of different varieties of apples by 29·2 –60·3 per cent. as compared with the control trees. The parasite was most effective where the eggs of the host were most concentrated. It was found best to release the parasite once only, during the period of mass oviposition of the moth, and the release of more than 2,000 individuals per tree did not appreciably increase the rate of parasitism.

Zimin (G. S.) & Kivit (O. I.). **Results of Application of *Trichogramma evanescens* Westw. against European Corn Borer in North Caucasus** (pp. 299–300). Experiments on the use of *T. evanescens* against *Pyrausta nubilalis*, Hb., on maize [**23** 567] were continued in 1935. It was released twice at the rate of 16,000 and 24,000 individuals per acre in 3 plantations of maize occupying a total area of about 390 acres. As a result, 44·4 per cent. of the eggs of *Pyrausta* were parasitised as compared with only 6 per cent. natural parasitism in the control plots, the infestation of the plants was reduced by 5–25 per cent. and the yield increased by 3·5–4·9 per cent.

Sidorovnina (E. P.). *Trichogramma* **in the Gardens of Azerbaijan** (pp. 300–301). The release of *T. evanescens* against the codling moth [*Cydia pomonella*, L.] at the mean rate of 20,000 per acre reduced the infestation of apples by about 50 per cent. Eggs of the moth on the windward side of the trees were most parasitised.

Tyumeneva. **Biological Method for the Control of Codling Moth by Means of *Trichogramma*** (pp. 302–305). In experiments in apple orchards in North Caucasus, the infestation of the fruit by the codling moth [*Cydia pomonella*, L.] was reduced by about 50 per cent. in plots in which *T. evanescens* was released at the rate of 2, 3 and 4 thousand parasites to a tree. The best results were obtained when the cards with parasitised eggs were placed on 4 sides of the periphery of the middle part of the crown.

Alekseev (Ya. A.). **Application of *Trichogramma evanescens* Westw. for the Control of Codling Moth** (pp. 305–307). As a result of the liberation of *T. evanescens* in a locality in the Leningrad Region on 27th June and 15th July at the rate of 3,000 individuals to a tree, infestation of apples by the codling moth [*Cydia pomonella*, L.] was reduced by 78·6 per cent., and the number of apples containing larvae of *Argyresthia conjugella*, Zell., was only half that in the control.

Afanas'eva (O. V.). *Trichogramma evanescens* **Westw. applied for Control against European Corn-borer in the Autonomous Moldavian SSR** (pp. 307–308). The release of *T. evanescens* against the codling

moth [*Cydia pomonella*, L.] on apple in Moldavia at the rate of 2,000 or 4,000 per tree reduced the number of infested fruits by an average of 35·1 per cent. On maize, the parasite was liberated at the rate of 10–30 thousand per acre on 13th and 26th July, at the beginning and peak of oviposition by *Pyrausta nubilalis*, Hb. As a result, only 3·3 per cent. of the maize cobs and 13·8 per cent. of the stems were damaged, as compared with 9·4 and 33·7 per cent., respectively, in the control plots.

Ruisakov. **Attempted Application of biological Method for the Control of European Corn-borer** (pp. 309–310). The loss caused by the second generation of *Pyrausta nubilalis*, Hb., to maize sown in mid-April in a locality in North Caucasus was reduced and the yield of the crop increased by 7·15 per cent. as compared with the control, following the liberation of *T. evanescens*, at the rate of 20–30 thousand per acre, when the moths were beginning to oviposit. In another plot, liberation at the time of maximum oviposition increased the yield by 10·75 per cent. In the case of maize sown in the first half of May, the yield was increased by 27·3 and 15 per cent., respectively, following liberations at the beginning and peak of oviposition of the moth.

Lapina (V.). **Application of *Trichogramma* for the Control of Cut Worm (*Euxoa segetum* Schiff.)** (pp. 311–313). Following an outbreak of the first generation of *Euxoa segetum*, Schiff., in a district in central Ukraine, *T. evanescens* was released in August, at the rate of 10–15 thousand per acre, in five-acre plots in which the moths were ovipositing. Averages of over 50 per cent. of the eggs were parasitised, and the number of larvae found was only half that in the control plots.

Sidorovnina (E. P.) & Ismailov (A.). **Distribution of *Aphelinus mali* Hald. in Azerbaijan and Determination of its Effectiveness in different Zones** (pp. 313–316). Surveys carried out in different districts of an area in Azerbaijan into which *Aphelinus mali*, Hald., had been introduced against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] in 1932 showed that it was parasitising 70–80 per cent. of the Aphids towards the autumn of 1934 and had spread for distances of about 4½ miles. Few of the Aphids on the roots and the root collar were parasitised. In 1935, infestation by *E. lanigerum* was considerably lower than in 1934, but the rate of parasitism decreased, as, owing to sharp fluctuations of temperature in spring, the emergence of *Aphelinus* was very irregular and continued from April to June. Supplementary liberations were therefore made in two districts in May and June, and surveys in the autumn showed that the parasite had checked the Aphid in them.

Samoĭlova (Z. I.). **Influence of Parasitism on the Quantity of Food consumed by infected or non-infected Larvae** (pp. 316–317). Experiments showed that larvae of *Euxoa segetum*, Schiff., parasitised by *Banchus falcatorius*, F., consume less food and assimilate a smaller amount of it than healthy larvae.

Pospelov (V. P.). **Results of the Investigations of microbiological Methods of Insect Pest Control** (pp. 318–321). In laboratory and field experiments carried out near Leningrad and in Moldavia, cultures of bacilli of the type of *Bacillus pirenei* proved to be very virulent to various Lepidopterous larvae. When applied in sprays against *Pieris* spp. on cabbage during sunny weather, they gave 90–100

per cent. mortality and remained effective for 20 days. They killed 35 per cent. of the larvae of *Pyrausta nubilalis*, Hb., on maize in western Ukraine, and increased the yield of the crop in the treated plot by 32·2 per cent. *Bacterium prodigiosum*, recovered from *Pseudococcus citri*, Risso, which was being reared at 100 per cent. humidity, proved to be virulent to various species of *Pseudococcus*. Larvae of *Euxoa segetum*, Schiff., were successfully infected by feeding them on a culture of the fungus *Sorosporella*, isolated from the larvae of the beet weevil [*Cleonus punctiventris*, Germ.]. Larvae of *Loxostege sticticalis*, L., were all killed when given food smeared with a culture of *Beauveria*, and the fungus was recovered from them. *Cephalosporium lecanii* attacked various Coccids in the coastal zone of the Black Sea. Fungi cultured from dead insects included *Spicaria fumosorosea* from *Feltia exclamationis*, L., *Metarrhizium anisopliae* from *Oryctes nasicornis*, L., and *Botrytis tenella* from *Melolontha melolontha*, L.

Pushin (F. E.). **Test Results of Power Machinery for Cotton Pests Control in the Uzbekistan SSR in 1935** (pp. 345–348). Notes are given on the increase in output obtained by using machines drawn by horses or tractors instead of hand apparatus for spraying or dusting cotton in Uzbekistan.

Spasskiĭ (A. F.). **Test of Motor-truck Spreader and Motor-truck Mixer in Field Conditions of Locust Control in Middle Asia** (pp. 349–351). A great reduction in the time and labour required in preparing and applying baits for the control of Acridids in Central Asia was obtained by using two machines, each of which is mounted on a motor truck and worked by its engine. One machine grinds the horse-dung for the bait and mixes poison with it ; the other broadcasts the bait, covering 15–20 miles in an hour in the open steppe, or 6–9 miles in wheat fields on uneven ground.

Kuznetzova (E. A.). **Study of the Action of the high Frequency Field on Insects** (pp. 373–374). In preliminary experiments to determine the effect of high frequency electric currents on the different stages of the granary weevil [*Calandra granaria*, L.] in wheat, mature larvae proved to be the most resistant. Adults outside the grains were killed more quickly than those within them. Exposures that were not quite lethal caused a coma that lasted 1–2 hours.

Balkashin (B. A.). **Influence of high Frequency Currents on Fecundity of *Calandra granaria* L.** (pp. 374–375). An account is given of the method adopted in studying the effect of sublethal exposures on fecundity in *C. granaria* ; the results are to be published later.

Andreev (S. V.). **Thermal and histological Analysis of the Action produced by the electric high Frequency Field upon Insects** (pp. 375–377). These experiments, in which *Blatta* (*Periplaneta*) *orientalis*, L., was used as the test insect, showed that the currents chiefly affect the central and back nerve ganglia of the thorax. The body-temperature of cockroaches killed in 10 seconds by electricity was 42–43°C. [107·6–109·4°F.], whereas it takes 7–10 minutes to kill cockroaches in a thermostat at 52–55°C. [125·6–131°F.].

Dodonov (B. A.). **Investigations of the Mechanism of Action of Stomach Insecticides and Resistance of Insects to the Poisons** (pp. 378–380). The larvae of certain Lepidoptera, such as *Euxoa segetum*,

Schiff., *Nygmia phaeorrhoea*, Dön., and *Porthetria dispar*, L., show great resistance to arsenical insecticides, since small doses do not kill them, and large ones cause them to eat less of the poisoned food and regurgitate the poison taken. Arsenicals should be replaced by fluorine compounds which, in spite of being less toxic, are able to produce a mortality of 80–90 per cent., as the larvae do not regurgitate, and consume the poisoned food better.

Voskresenskaya (A. K.). **Reaction of throwing out the Poison being the Cause of Resistance of Insects to arsenical Compounds** (pp. 380–383). Observations showed that resistance to arsenicals in the larvae of certain insects (*Euxoa segetum*, Schiff., and *Porthetria dispar*, L.) is not due to their digestive tract being less permeable than that of susceptible larvae (*Pieris* spp.), but to the fact that 30–40 per cent. of the poison ingested is regurgitated. Resistant larvae regurgitate within a few hours, whereas susceptible larvae only do so after almost all the poison has penetrated into the organism. The dose that first causes regurgitation (threshold dose) is smaller than the minimum lethal dosage, and decreases in proportion to the resistance of the species. The muscles of the intestinal tract are brought into motion chiefly by the rhythmic contractions of the fore and hind sphincters, and the degree of the activity of these muscles varies in different species of insects. A reaction to arsenic on the part of the fore sphincter takes place in all species that are resistant to arsenical compounds, and is absent in those that are susceptible. The effectiveness of arsenicals in the case of resistant species may, however, be increased by the addition of such substances as atropine, pilocarpine or adrenalin, which reduce the contractions of the intestinal tract or prevent regurgitation.

Skryabina (E. A.). **Tissue Respiration and its Importance for the Resistance of Insects to Arsenic** (pp. 383–386). Arsenic kills insects by depressing the tissue respiration. Tests with sodium arsenite showed that the tissue respiration of the fifth-instar larvae of resistant and susceptible species (*Euxoa segetum*, Schiff., and *Pieris brassicae*, L.) is lowered in an equal degree. There is no difference in the threshold dose of the poison that causes the depression, but the minimum lethal dosage is considerably higher in the case of *E. segetum*. The depression begins more quickly in this species, and it is physiologically more susceptible to arsenic than is *P. brassicae*, but, from the practical point of view, this results in its being less susceptible, as it regurgitates the poison much sooner.

Dodonov (B. A.). **Study on the Quantity of poisoned Food consumed by Insects** (pp. 386–388). Experiments in which larvae of *Euxoa segetum*, Schiff., and *Pieris brassicae*, L., were given poisoned food showed that Paris green is eaten more readily than sodium arsenite and less readily than sodium fluosilicate. It appeared that the larvae are not directly repelled by the insecticide, and that they begin to refuse treated food only after a certain amount of it has entered the intestinal tract and caused a reaction to the toxic effect of the poison. The decrease in the consumption of food treated with arsenicals is particularly manifested in species, such as *E. segetum*, that are the most resistant to arsenic.

Éidel'man (Z. M.) & Novikova (N. G.). **The Effect of Spraying with Mineral Oil Emulsions on the photosynthetical Property of Leaves**

of the Apple Tree in Connection with the Viscosity and superficial Tension of the Oils (pp. 392–395). If *Citrus* and apple trees are sprayed with oil emulsions, the normal gaseous interchange in photosynthesis of the leaves is restored considerably more rapidly in the apple. Such rapid restoration is due to the fact that the spongy parenchyma of the apple leaves possesses large intercellular spaces, which facilitate the rapid passage of the particles of oil that would otherwise interfere with photosynthesis. The close relation between the time required for the leaves to regain normal activity and the viscosity of the oil used was confirmed in investigations on the accumulation of starch in the treated leaves [*cf.* **24** 705]. When oils of higher viscosity were applied, the synthesis of starch was affected to a greater extent and for a longer period than the gaseous interchange in photosynthesis [*cf.* **25**]. Reducing the surface tension of the oil (by adding seal fat to it) decreased considerably the degree of its penetration into the tissues of the leaf and thus reduced the degree of the disorganisation in the intensity of photosynthesis.

Bogdarina (A. A.), Kazakova (M. P.) & Osipova (N. A.). **Investigations of chemical Properties of Emulsifiers as to their Ability to injure green Organs of Plants when Spraying with Mineral Oil Emulsions** (pp. 395–398). Tests of oil sprays to compare the toxicity to plants of the soaps used as emulsifiers showed that soaps made of fatty acids cause little if any damage to the plants, and that the neutral sodium, potassium and ammonium soaps prepared from naphthene acids are the most injurious. In the process of emulsification, the oil takes up a certain amount of acids from the soap, and as the naphthene acids are extremely toxic to vegetable tissues, spraying with oil emulsions containing them scorches the plants. The maximum amount of acids is taken up by the most refined oils. The toxicity of oil emulsions to the plant is reduced when soaps with a surplus of alkali are used as emulsifiers, since the alkali not only neutralises the naphthene acids released in the process of hydrolysis, but also reduces the acidity of the oil. Soaps with a potassium base proved to be the best emulsifiers, as they improved the process of emulsification and produced more stable concentrations. Oil emulsions with soap prepared from naphthene acids are easier to emulsify, cause less injury and are more stable if the molecular weight of the acids is high (250) ; if it is low, severe scorching is caused, and if it is very low (180), no emulsion is obtained. Soaps prepared from naphthene acids having a molecular weight of not less than 250 may be used as emulsifiers, provided that a solution containing potassium hydroxide at the rate of 30–40 per cent. of the weight of dry soap is used with them. Of all the soaps tested, the least injurious to the plants were those prepared from oleic or seal fat acid with a potassium base.

Kiyashko (P. I.). **Determining the Limits of Concentrations of HCN for the Seedlings of Apple and Pear Trees** (p. 398). Dry two-year-old apple and pear seedlings were fumigated with hydrocyanic acid gas generated from sodium cyanide by the pot method at a temperature of 10·8–13°C. [51·44–55·4°F.], the exposure lasting 1 hour. The seedlings were not affected when the concentration of HCN was not greater than 0·6 oz. to 100 cu. ft. A concentration of 0·621 oz. (obtained from 1·5 oz. sodium cyanide) slightly retarded their development, and concentrations of about 12 oz. or more killed all the young buds and thin lateral twigs and retarded development by two weeks.

Kiyashko (P. I.). **Comparative Effectiveness of Action of HCN in high Concentrations with short Exposures or low Concentrations with prolonged Exposures on Apple and Mandarin Trees** (pp. 398–401). Experiments in which mandarin orange and apple trees in pots were fumigated with hydrocyanic acid gas showed that low concentrations of gas with long exposures are less injurious than high concentrations with short exposures. Thus, the plants were badly scorched after an exposure of 15 minutes to a concentration of 1·5 oz. HCN (obtained from 4·5 oz. sodium cyanide) per 100 cu. ft., whereas the apples were not affected and the mandarins only slightly by a concentration of 0·73 oz. with an exposure of 5 hours. On the whole, mandarins were more easily injured than apples. Moreover, low concentrations with long exposures had practically no effect on the respiration of the plants, whereas high concentrations with short exposures disorganised it considerably.

Sazonov (P. V.). **Influence of Mineral Oil added to Dust Insecticides on their Settling Properties** (pp. 401–403). In experiments to ascertain whether the addition of mineral oil to a dust insecticide improves the settling of the dust cloud, a definite quantity of calcium arsenate or sodium fluosilicate, alone or mixed with different amounts of spindle oil, was released from a special apparatus fixed at a height of 20 ft. The amount of the dust that precipitated within 15 minutes of release was then determined by comparing the quantities that settled on small glass plates exposed for periods lasting from a few seconds to 12 minutes. With the addition of spindle oil to calcium arsenate at the rate of 5 per cent. or more of the weight of the mixture, the amount of the preparation that settled on the glass plates gradually increased; 15 per cent. of oil increased it by 50 per cent., the maximum quantity settling between 25 seconds and 3 minutes after release. The part of a dust cloud that is likely to be carried away before it settles consists chiefly of the more minute particles, which precipitate slowly. The mineral oil introduced into the dust caused these to adhere to one another and so settle more quickly. In the case of sodium fluosilicate, with which less oil was used, there was a greater tendency for the larger particles to adhere, so that the increase in settling due to the oil occurred more quickly. The degree of mutual adherence of the particles is in direct relation to the amount of oil in the dust and in inverse relation to the surface tension of the oil. The maximum amount of spindle oil to use with calcium arsenate or sodium fluosilicate is 15 and 0·5 per cent. of the weight of the mixture respectively, as a greater amount chiefly causes the adherence of the larger particles, which settle quickly without the oil.

Kozlova (E. N.). **Amount of added Bonificator depending on the specific Surface of the Dust Insecticide** (pp. 404–406). Mixing a small quantity of oil with a dust insecticide increases its adhesiveness, but the amount of the oil required depends on the specific surface of the dust. A method of ascertaining the specific surface is described. The adhesiveness of sodium fluosilicate, the specific surface of which is 0·28 sq. m. per gm., increases by 20 per cent. if 0·13 per cent. by weight of mineral oil is added, whereas in the case of calcium arsenite, the specific surface of which is 2·51 sq. m., 1·18 per cent. of oil gives the same increase. The increase in adhesiveness depends directly on the amount of the oil added, up to a certain limit, beyond which no further

increase occurs. In the case of sodium fluosilicate, calcium arsenite and calcium arsenate, the maximum amount of mineral oil that can be added with positive results is 1·3–1·7, 13·4 and 25 per cent. by weight, respectively.

Polyakov (I. M.). **Physico-chemical Principles of Construction of the most efficient Poison Dusts** (pp. 406–410). The increased effectiveness of insecticidal or fungicidal dusts after the addition of an oil does not depend on the viscosity of the oil, but on its adhesiveness to the dust, the adhesiveness of the mixture to the leaf surface of the plant, and the stability of the oil film. The polarities of the dust, the carrier, if one is used with it, and the oil should therefore correspond, and the polarities of the molecular surfaces of the oil and of the leaves of the plants to be treated should be taken into consideration.

Sazonov (P. V.). **Technical Effectiveness of Dusts mixed with Oil** (pp. 410–411). This is a brief account of experiments already noticed [**25** 130].

Derkunskaya (T. V.). **Study of Bonificators** (p. 412). In laboratory tests in Central Asia of substances likely to increase the effectiveness of lead arsenate suspensions against the codling moth [*Cydia pomonella*, L.], the deposit of lead arsenate on the apple surface increased if gelatine, calcium caseinate, cresol, gum-arabic, starch, skimmed milk, or water extracts of lucerne or the root of soapwort [*Saponaria officinalis*] were added to the spray. Both gelatine and skimmed milk resulted in an even but very thin deposit over the whole surface of the apples; to increase the quantity of lead arsenate per sq. cm., it is necessary to increase its concentration in the suspension.

Edel'man (N. M.). **Industrial Application of the Hydrogen Sulphide Method of Granary Pest Control** (pp. 422–423). Complete mortality of mites in stored wheat was obtained in 48–72 hours by fumigating with hydrogen sulphide [*cf.* **25** 8] at the rates of 15–35 oz. per 100 cu. ft. in wooden elevators, or 40 oz. in granaries. The rate of the application depends on the moisture of the wheat, the minimum effective against mites being 12 oz. to 100 cu. ft. if the humidity of the grain is 12 per cent, and 35 oz. if it is 19·5–24 per cent. In experiments on the fumigation of empty sacks, complete mortality of mites and *Calandra granaria*, L. [*cf.* **25** 7], placed in cages in the corners and centre of the chamber, was obtained in 24 hours with 13 and 20 oz. per 100 cu. ft., respectively. At rates of up to 40 oz. per 100 cu. ft., hydrogen sulphide did not reduce the germination of the seeds of most of 70 varieties of wheat or 50 kinds of vegetables tested.

Paĭkin (D. M.). **Comparative Effectiveness of short Exposures to high Concentrations and prolonged Exposures to low Concentrations** (pp. 432–434). Haber's formula [**23** 121, 258], according to which the product of the concentration of a fumigant and the time of exposure required to produce mortality is constant, was not confirmed in experiments in which adults of *Calandra granaria*, L., were fumigated in glass containers with liquid hydrocyanic acid, the concentrations being 0·9, 15, 55, 80 and 114 mg. per litre and the exposures lasting 22 hours and 80, 24, 15 and 5 minutes, respectively. The percentage mortality on the first day after fumigation was very low for the lowest concentration, and high for the others, and the effect of the former was also less on subsequent days.

Paĭkin (D. M.). **Application of Cyanide for Fumigation of decorative Plants** (pp. 434–435). In experiments to test whether fumigation with low concentrations of hydrocyanic acid gas and exposures long enough to produce complete mortality of *Pseudococcus gahani*, Green, would injure ornamental plants, *Citrus* and tobacco [*cf.* **24** 581], 100 per cent. mortality of the Coccid was obtained with 4 oz. calcium cyanide per 1,000 cu. ft. and exposures of 6, 12 and 24 hours at a temperature of 15–25°C. [59–77°F.]. The plants were scorched, especially when fumigated for 24 hours, but recovered in 1–1½ months after shedding their foliage as a result of scorching. No damage was caused by exposures for 3–6 hours to dosages of 1 and 2 oz. per 1,000 cu. ft., which killed 50–80 per cent. of the Coccid.

Astrakhantzev (P. I.), Belugin (N. O.), Bogolyubov (N. V.) & Borozdina (K. I.). **Chemico-toxicological Investigation of** *Melia azedarach* (pp. 455–457). Water or alcohol extracts (neutral, acid or alkaline) of the fruits of *Melia azedarach* were prepared to contain the equivalent of 32 gm. fruits per 100 cc. and tested as sprays on the cabbage aphis, *Brevicoryne brassicae*, L. The alkaline alcohol extracts were the most effective, giving 97–98 per cent. mortality 48 hours after application. If the alcohol was removed, however, the toxicity of the extracts decreased, apparently owing to the decomposition of the active principle. An alcohol extract of the seeds of *Melia*, after the oil had been extracted from them, gave 33·6 per cent. mortality, and a neutral alcohol extract of the leaves, tested a year after it had been prepared, gave 45 per cent.

Blumberg (G.), Shpital'naya (E.) & Belugin (N.). **Toxicological Study of** *Aconitum napellus* (pp. 457–459). In tests in which *Brevicoryne* (*Aphis*) *brassicae*, L., was sprayed with extracts of *Aconitum napellus*, prepared by infusing the dried roots in 70 per cent. alcohol or 3 per cent. water solutions of sodium hydroxide or sulphuric acid, the sodium hydroxide extracts proved to be the most effective, killing 49 per cent. of the Aphids at a concentration equivalent to 40 mg. dry root to 1 cc.

Nesterchuk (A. I.). **Pyrethrum in the Control of Vegetable Pests** (pp. 459–461). Very good results were obtained in experiments in the Leningrad Region with pyrethrum dusts or sprays against a large number of different pests of vegetables. Spraying with alcohol or kerosene extracts was particularly effective against *Tetranychus telarius*, L., on cucumbers in greenhouses, and dusting with a mixture of equal parts of pyrethrum and talc gave a high rate of mortality of *Gastroidea* (*Gastrophysa*) *viridula*, DeG., on sorrel, and *Meligethes aeneus*, F., and *Phyllotreta* spp. on crucifers.

Semenov (A. E.). **Study of Degree of Injury caused by Flea-Beetles on Flax of super early, early and normal Dates of Sowing** (pp. 549–554). Investigations in central Russia showed that infestation of flax by *Longitarsus parvulus*, Payk., and *Aphthona euphorbiae*, Schr., is more severe the later the flax is sown ; the number of flea-beetles was 45 times as great on plants sown on the latest date (13th June) as on those sown on the earliest date (6th April). The early sowings escape infestation, or are only slightly attacked, because the plants can

develop at low temperatures and are 1½–3 ins. high when the flea-beetles first appear, which they do when the temperature rises above 15°C. [59°F.]. Furthermore, flax sown in April is harvested at the beginning of August, before the adults of the summer generation commence to increase in numbers and attack the upper parts of the stems, damaging the fibre [*cf.* **23** 578]. The severest infestations occurred on flax sown on medium and late dates (7th May–13th June), and the flea-beetles chiefly concentrated on the lower plants, to which they probably migrate from the taller ones.

Paterilo (G. A.). **Effectiveness of Control Measures against Pests and Diseases of Gardens in Azerbaijan** (pp. 554–556). Very effective control of the apple moth [*Hyponomeuta padellus malinellus*, Zell.] was obtained in the north-east of Azerbaijan by applying sprays of Paris green in Bordeaux mixture at the rate of 63 gals. per acre, or about twice the rate previously used. It is estimated that 100 per cent. mortality of the larvae was obtained in 1934 and 96·7 per cent. in 1935, and that the value of the increase in the apple crop was about 17 times the cost of control.

A bibliography of scientific works that were published by the Institute of Plant Protection during 1935 is appended (pp. 566–572) and indices are given (pp. 573–579) to the Russian and scientific names of the pests, diseases and plants mentioned in the Report, as well as to the Russian names of the insecticides and fungicides and the machinery used in the control of pests.

[Zolotarev (E. Kh.).] **Золотарев (Е. Х.). The Asiatic Locust in the southern left-bank Districts of the Kuibysheff Province** [*In Russian.*]—*Zool. Zh.* **15** no. 4 pp. 731–746. Moscow, 1936. (With a Summary in English.)

Following the appearance of dense bands of hoppers of *Locusta migratoria*, L., on the terraces of the central part of the river Volga, a study was made of the ecological and climatic conditions of this area, where the severity of the winter and the variability of the temperature in spring are considered to be inimical to mass appearances of locusts. The eggs are usually laid on the warm, sandy southern slopes of the middle terrace, where, however, they have no protection against frost or desiccation, for in the winter the snow cover is blown off the exposed slopes and the ground freezes hard, while in spring it rapidly dries up under the influence of high temperatures by day and frost by night. Mass appearances of locusts can apparently take place only when the pools in old river channels and depressions that occur on the wide upper terrace begin to dry up. The 1935 outbreak was brought about by the drying up of the Maĭtuga depression, which up to 1932 had contained a shallow lake ; this was due to decreased precipitation and the consequent fall in the level of the water table, as well as to the decrease of run-off of water from the surrounding fields into the depression, during the melting of the snow, owing to improved methods of agriculture. The eggs laid at the bottom of the depression were protected from freezing by snow collecting in it, and there was abundant green food for the developing hoppers. The probability of further outbreaks in the Maĭtuga depression during the next few years is stressed.

Husain (M. A.) & Mathur (C. B.). **Studies on *Schistocerca gregaria* Forsk. VIII. Influence of Carbon Dioxide on Development of Black Pigmentation in *Schistocerca gregaria* Forsk.**—*Indian J. agric. Sci.* **6** pt. 5 pp. 1005–1030, 3 pls., 4 figs. Delhi, October 1936.

Experiments, the technique of which is described, were made on the effect of a 3 per cent. concentration (by volume) of carbon dioxide on the colouration of isolated hoppers of *Schistocerca gregaria*, Forsk., kept at temperatures of 30, 40 and 44°C. [86, 104 and 111·2°F.] and relative humidities of 80–90 per cent. The hoppers developed black pigmentation similar in extent and intensity to those that develop in crowded hoppers bred at these particular temperatures [*cf. R.A.E.*, A **24** 738]. A biometrical study showed, however, that they retained the body proportions of phase *solitaria*. In some cases, hoppers bred in the 3 per cent. concentration of carbon dioxide passed through an extra instar, between the third and fourth ; a 7 per cent. concentration was found to be fatal. Descriptions and coloured plates of fifth-instar hoppers bred in excess of carbon dioxide are included.

Rao (Y. R.). **The Locust Incursion of 1935 in north-west India—its Significance in the Study of the Locust Problem.**—*Indian J. agric. Sci.* **6** pt. 5 pp. 1031–1053, 1 fig., 2 maps. Delhi, October 1936.

Most of the information on *Schistocerca gregaria*, Forsk., contained in this paper has already been noticed [*R.A.E.*, A **22** 121–122 ; **24** 236, 443]. The numerous individuals of phases *transiens* and *gregaria* that appeared in July 1935 among the *solitaria* populations of the coastal areas of Baluchistan and in the Sind-Rajputana desert areas are thought to have been the progeny of the generation bred during the preceding winter in the coastal areas of Mekran. The young adults appearing there in April, together with adults of the preceding generation, seem to have migrated into the interior valleys of Mekran, where rain had fallen in April and where sites suitable for egg-laying are restricted to silt accumulations on river banks and sandy beds of streams. It is probable that a concentration of phase *solitaria* migrants occurred at such spots at oviposition time, and the resultant hoppers underwent compulsory crowding on patches of cultivated *Sorghum*, which caused them to assume the characteristics of phases *transiens* and *gregaria*. On reaching the adult stage, they imperceptibly migrated to the coast of Baluchistan and to north-western India.

It is recommended to concentrate control measures in such outbreak centres in the interior of Mekran, where it would be comparatively easy to deal with the concentration of hoppers at the time of incipient swarming. Since they probably occur in Persian as well as Indian Mekran, international co-operation would be essential to ensure efficient control.

Roubaud (E.). **Recherches expérimentales sur le criquet pèlerin.**—*Bull. Soc. Hist. nat. Afr. N.* **27** pp. 387–391. Algiers, 1936.

In a stock of *Schistocerca gregaria*, Forsk., kept in a laboratory since 1932, both the isolated and crowded individuals now approach phase *solitaria*. Locusts bred against a white background had pale striated

eyes and a paler colouration than those bred against a black one [*cf. R.A.E.*, A **20** 671] ; in the former the larval development was longer, but sexual maturation was more rapid, than in the latter. Observations were made suggesting that the rate of sexual maturation and colour changes are not always dependent on environmental factors. Some lots of phase *transiens* oviposited without changing colour. Under laboratory conditions, maturation was usually reached 3 weeks after the last moult, but in some cases in the 2nd and 3rd continuously bred generations it was delayed by 3 months and in the 4th and 5th by 5 months.

MURAYAMA (J.). **Rapport sur les moyens répressifs employés contre les hannetons. III. Recherches sur la vie et moeurs chez le *Phyllopertha pallidipennis* Reitter.** [*In Japanese.*]—*Bull. For. Exp. Sta. Chosen* no. 23, [6] 164 pp., 10 pls., 161 refs. Keijo, August 1936. (With a Summary in French.) [Recd. December 1936.]

This paper, which is one of a series on cockchafer beetles in Korea [*cf. R.A.E.*, A **23** 340], where the larvae sometimes destroy 70 per cent. of the nursery forest plants, presents the results of 10 years' work on the Rutelid, *Anomala* (*Phyllopertha*) *pallidipennis*, Reitt., which is the most injurious species. It is found throughout Korea and also in some districts of Japan and Manchuria, and it attacks the roots of various leguminous plants as well as those of certain forest trees [*cf.* **23** 370]. All stages are described, and an account is given of its life-history [*loc. cit.*]. Soil treatment with insecticides is one of the measures recommended against the larvae, and tests with 27 substances showed that carbon bisulphide, pure or as an emulsion, paradichlorobenzene and lead arsenate are among the most effective.

SMITH (J. H.). **White Grub Damage to Pastures on the Atherton Tableland.**—*Qd agric. J.* **46** pt. 4 pp. 446–466, 3 figs., 12 refs. Brisbane, 1st October 1936. **White Grub Injury to Pastures elsewhere in Queensland.**—*T.c.* p. 467.

The following is largely taken from the author's summary and conclusions : The Melolonthid, *Lepidiota caudata*, Blkb., has been a serious pest of pastures on the Atherton tableland of Queensland for some years. The pasture deterioration due to this and other causes is now so pronounced in that area that dairy-farming under present methods is scarcely profitable.

Flights take place during the spring when the first storms of the wet season have softened the soil to the depth of the pupal chambers so that the beetles can penetrate to the surface. At dusk, vast numbers of adults emerge and fly directly to buildings, trees, fence posts, etc., where pairing occurs. Before dawn, they drop to the ground and burrow under the surface, resuming the flight at dusk. This behaviour probably accounts for the fact that injury is frequently severe near trees, stumps and along fences, although it is also present in pastures where these do not occur. Development requires two years and injury to the pasture is usually greatest during the second year of larval life [*cf. R.A.E.*, A **20** 155]. It is thus possible to forecast the probable damage in any year by referring to the intensity of previous flights. The only known natural check is a dry spring, which prevents the beetles

from emerging from the ground; in 1932, the generation that was due to fly was nearly exterminated in this way. Prior to 1927, dry springs were common on the Atherton tableland, and the insect was controlled naturally. Its present importance can be attributed to wet springs in 1929, 1931 and 1933. Its activity is confined to the acid soils (pH 5·5 or less) on the tableland. Acidity probably reflects the magma types from which these soils were derived, but will become intensified by the leaching to which they are subject. It is thus probable that the area liable to attack will gradually extend, particularly in the vicinity of the coastal range where the rainfall is heaviest. The common failure of previously infested land to crop well during its first year under the plough is invariably due to an alteration caused by the larvae in the soil-moisture relationship. An interval of about 12 months elapses before the return to normal.

Measures used for the control of white grubs on sugar-cane are too expensive for pasture areas, nor do they give permanent relief. Experiment showed that the adults of *Lepidiota caudata* are not attracted to lights; they probably settle on houses when in flight, as on any other vertical surface. Better results would be given by alterations in agricultural practices, such as conservation of fodder for use when grazing reserves are depleted, and better pasture management with the aid of rotational grazing and lighter stocking with grade cattle, so that the loss is decreased. In the infested areas, entomological considerations must influence any mixed farming system. The following are the most important of these: The practicability of forecasting serious infestation renders it possible in normal seasons to accumulate reserves for any anticipated fodder shortage. Eggs of *L. caudata* are rarely laid in fallow ground, hence grass should be broken up early in the flight season. If the flight of adults in any year presages heavy pasture damage 18 months later, a suitable area on which fodder reserves can be grown should be brought under cultivation as soon as the intensity of the flight can be estimated. The mouldboard plough is much more suitable for pasture renovation than the disk type, for the more complete soil cover obtained acts as a deterrent to oviposition. Pigs should only be released in the field during the late spring, when they consume numbers of adults concealed in the soil, and in summer, when they root up the larvae, at both of which times good growing conditions are assured.

The second paper comprises brief notes on other white grubs that cause damage to pastures in Queensland but are less injurious than *L. caudata*. The identity of some of the species involved in the recorded outbreaks is still uncertain, but all those of economic importance in pasture land are found in friable red or chocolate loams, which originally carried a typical rain-forest flora. *L. laevis*, Arrow, which completes its life-cycle in two years, is restricted to a small area of alkaline soil on the Atherton tableland, where it is as destructive as *L. caudata*. The adults are strongly phototropic, and large numbers can be trapped at lights. There has been no significant spread of infestation for the last 20 years. *Pseudoholophylla furfuracea*, Burm., has been found damaging pastures in the vicinity of sugar-cane, of which it is a serious pest. Herbage types appear to be relatively unimportant in modifying the behaviour of this beetle during flight or in determining the place of oviposition and subsequent injury. The life-cycle covers two years. Several species of *Rhopaea*, the life-histories of which have not yet been worked out, are relatively common

in Queensland. Two outbreaks in the south both caused injury similar to that by *L. caudata*, crops such as ground-nuts and maize planted in newly-ploughed grazing land suffering from attack by the larval population remaining over from the pasture.

VEITCH (R.). **Presidential Address.**—*Proc. roy. Soc. Qd* **48** no. 1 reprint 19 pp., 21 refs. Brisbane, 1936.

The greater part of this address deals with the development of economic entomology in Queensland, and particularly with work done on representative pests, most of which has been noticed previously [*R.A.E.*, A **13** 348; **24** 1, 196; **25** 162; B **20** 83]. In connection with the problem of the Queensland fruit-fly, *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.), and work on its control [A **22** 61; **23** 116; **24** 244, etc.], the evidence bearing on the seasonal reinfestation of fruit in the Stanthorpe district is reviewed. This may be explained in three ways: by the overwintering of some stage of the fly in the district; by the importation each year of infested fruit; or by the migration of the flies from some other district where breeding occurs. With regard to the first of these suggestions, H. Jarvis showed in 1926 that, although a small percentage of larvae infesting late fruit (such as quinces and late apples) might overwinter, the number would probably be too small to cause reinfestation in the spring. Perkins found that some pupae may overwinter [**13** 405]; but infestation by this means is unlikely. There is no evidence that the adults overwinter. In order to test the second suggestion, for some years all fruit entering the Stanthorpe district was stored for a time at temperatures below 35°F., so that all stages of the fly were killed. As the infestation was still severe during these years, it could not have been entirely due to the importation of infested fruit. In connection with the third suggestion, the state of the ovaries and wings of the first adults of *D. ferrugineus* to appear in the Stanthorpe district every year shows that they are already old. As a careful watch is kept for the first appearance of the fly, it is unlikely that the first batch to emerge in the district would always remain unnoticed for this length of time. In the same way, *D.* (*C.*) *jarvisi*, Tryon, which occurs in the Stanthorpe district and attacks deciduous fruit, first appears there each year in early February. It is difficult to see how this fly could remain undetected for so long each season if it were permanently present in the district. *D.* (*C.*) *dorsalis*, Hend., appears in the Stanthorpe district in early spring and is frequently taken in traps before *D. ferrugineus* is found. This fly does not attack deciduous fruits, and its common food-plants (two species of *Solanum*) are not found in this area. Thus the known circumstances in which all these flies appear seem to be explicable on the theory of yearly migration from areas more suitable for breeding. Although migration is the chief, if not the only, factor causing the initial infestation each season, much of the continued infestation is due to the local breeding of the flies.

NEWMAN (L. J.) & JENKINS (C. F.). **Fruit Fly**—*Ceratitis capitata*. **Baiting, Trapping and Luring Experiments.**—*J. Dep. Agric. W. Aust.* (2) **13** no. 3 pp. 345–349, 2 figs., 1 ref. Perth, W.A., September 1936.

In experiments against *Ceratitis capitata*, Wied., in Western Australia, 6 bait-sprays, containing lead arsenate or sodium fluosilicate

as poisons, and sugar or molasses as sweetening agents, were tested in the laboratory, their efficiency being estimated by the time necessary to kill all of a batch of 50 flies. Molasses retarded the lethal effect of both poisons [*cf. R.A.E.*, A **22** 353]. A bait-spray containing 1 oz. sodium fluosilicate, 2½ lb. sugar and 4 gals. water is recommended; one gallon should be sufficient for 16 trees. The spray should be applied at least once every 7 days and renewed when washed off by heavy rain. If sodium fluosilicate is not procurable, a spray containing 3 oz. powdered lead arsenate, 2½ lb. sugar and 4 gals. water should be used.

The most efficient trap of 4 tested over a period of about 7 weeks was one made from a metal screw-topped glass jar holding about half a pint. A hole about 1 inch in diameter is cut out in the centre of the lid to admit the flies, and over it is soldered a piece of galvanised iron in the shape of a hood open at both ends. To this hood is attached a piece of wire by which the trap is suspended in the tree. In small orchards of up to 200 trees trapping is advised, but in larger ones it is not economical, at least 2 traps being required per tree. Clensel was the most efficient bait, 1 part to 30 parts water being recommended.

New South Wales: **Plant Diseases Act, 1924, Proclamation.**—*Govt Gaz.* no. 150, reprint 1 p. Sydney, 25th September 1936. **Plant Diseases Act, 1924, Proclamation.**—*Op. cit.* no. 156, reprint 1 p. 9th October 1936.

The regulations for fruit-fly control in the first proclamation are similar to those already noticed [*R.A.E.*, A **20** 167; **21** 130]. The new provisions include a modification with regard to the dates by which all oranges and mandarins of certain specified varieties must be removed from the trees, and a revision of the districts in which two of the regulations for the destruction of infested fruit apply. The formula for the bait-spray [**20** 168] contains 4 instead of 5 oz. lead arsenate, and the amount prescribed for each application is decreased to 6 fl. oz. [*cf.* **21** 130].

The second proclamation modifies further the area of application of the two regulations for destruction of infested fruit.

New South Wales: **Plant Diseases Act, 1924. Proclamation.**—*Govt. Gaz.* no. 150 reprint 1 p. Sydney, 25th September 1936. **Plant Diseases Act, 1924. Proclamation.**—*Op. cit.* no. 156 reprint 1 p. Sydney, 9th October 1936.

The regulations against *Cydia pomonella*, L., in the first proclamation are similar to previous ones [*R.A.E.*, A **17** 103]. The modifications include a revision of the area in which two of the methods for disposal of infested fruit apply, and the provision of an alternative to banding with sacking in the use of corrugated cardboard bands impregnated with a mixture of lubricating oil and beta-naphthol, which must be in place during the same period. The larvae and pupae in the impregnated bands need only be destroyed at the time of removal. A spray containing at least 24 oz. lead arsenate powder in 50 gals. water must be applied to apple, quince and pear at intervals not exceeding three weeks, in some districts until the whole of the fruit is harvested, and in others until the fourth spray has been completed.

The second proclamation modifies further the area in which the two methods for disposal of infested fruit apply.

Mamet (R.). **Note sur les cochenilles de l'Ile d'Agaléga.**—*Rev. agric. Maurice* no. 88 pp. 152–153, 1 ref. Port Louis, 1936.

A list is given of the Coccids of Agaléga, a small island about 600 miles north of Mauritius, with their food-plants if known. Amongst those identified specifically are *Saissetia coffeae*, Wlk. (*Lecanium hemisphaericum*, Targ.), and *Pinnaspis marchali*, Ckll., on *Sechium edule*, *Lepidosaphes beckii*, Newm., on *Citrus*; and *Chrysomphalus ficus*, Ashm., on coconut (*Cocos nucifera*).

Lopez Cristobal (U.). *Tetrastichus lopezi* **Blanchard.**—*Bol. inf. Lab. Zool. Ent. agric., Fac. Agron. Univ. nac. La Plata*, 4 pp. multigraph, 3 figs., 4 refs. La Plata, July 1936. [Recd. December 1936.]

The Pierids, *Tatochila autodice*, Hb., and *Ascia* (*Pieris*) *monuste automate*, Burm., often occur together on cabbage in La Plata, Argentina, where they have three generations a year and appear in large numbers every four or five years. The larvae of both species are usually heavily parasitised by *Apanteles williamsoni*, Blanch., but breeding experiments over two years have shown that the latter is itself parasitised by a new species of Eulophid, *Tetrastichus lopezi*, a brief description of which by Blanchard is included. It is to the action of this hyperparasite that the periodic outbreaks are attributed. The adults appear when the larvae of *A. williamsoni* are present in the caterpillars, and deposit up to 3 eggs in each, avoiding those that have already been parasitised. From a batch of 26 parasitised Pierids, on each of which there were 12–18 cocoons of *A. williamsoni*, the author obtained 4 males and 2 females of the latter and a large number of *T. lopezi*.

Lopez Cristobal (U.). *Apanteles galleriae*. **Ichneumónido parásito de las polillas de la colmenas. Su ineficacia para la lucha biológica.** [*A. galleriae*, the Braconid Parasite of Wax Moths. Its Inefficiency in biological control.]—*Bol. inf. Lab. Zool. Ent. agric., Fac. Agron. Univ. nac. La Plata*, 1 p. multigraph. La Plata, August 1936. [Recd. December 1936.]

In the summer of 1935, the author observed a Braconid, identified as *Apanteles galleriae*, Wlkn., in beehives infested with *Galleria mellonella*, L., and *Achroia grisella*, F. No species of *Apanteles* had previously been noted in Argentina as a parasite of the wax moths. In experiments in which *A. galleriae* was placed in cages with *G. mellonella*, it only parasitised a few larvae of the latter, and it is concluded that it is of no value in their control.

Fleming (W. E.) & Metzger (F. W.). **Control of the Japanese Beetle and its Grub in Home Yards.**—*Circ. U.S. Dep. Agric.* no. 401, 14 pp., 8 figs., 3 refs. Washington, D.C., September 1936.

This circular, which is a revision of a previous one [*R.A.E.*, A **22** 633], contains a brief account of various measures for the control of *Popillia japonica*, Newm., in gardens, etc., in the United States.

GNADINGER (C. B.). **Supplement to the Second Edition of Pyrethrum Flowers.**—Demy 8vo, 18 pp., 92 refs. Minneapolis, Minn., McLaughlin Gormley King & Co., 1936.

The second edition of the work referred to appeared in April 1936 [*R.A.E.*, A **24** 564], and in this supplement further information, most of which was published in the 7 succeeding months, is arranged under the same chapter headings. The greater part of it deals with the chemical evaluation of pyrethrum, with the correlation of chemical and biological tests, and with household insecticides.

JANES (M. J.) & HAGER (A.). **Studies on the Incubation of the Chinch Bug Egg.**—*Iowa St. Coll. J. Sci.* **10** no. 4 pp. 395–402, 3 diagr., 6 refs. Ames, Iowa, July 1936. [Recd. December 1936.]

The following is based on the authors' summary of experiments carried out in Iowa. Eggs of *Blissus leucopterus*, Say, hatched in approximately 30, 15, 10 and 7 days at temperatures of 19·5, 24·5, 29·5 and 34·5°C. [67·1, 76·1, 85·1 and 94·1°F.], respectively. Temperature seemed not to affect appreciably the percentage of hatch. In each case there was considerable variation in the time of hatching of a given lot of eggs subjected to the same conditions. Relative humidity, although apparently influencing the length of the incubation period in some cases to a slight extent, has its greatest effect on the percentage of hatch. The most favourable relative humidity at the higher temperatures was 80 per cent. In one case, 98 eggs hatched out of a lot of 100. The eggs hatched after submergence in water for considerable periods, some doing so after 15 days of submergence at 24·5°C. At higher temperatures, the eggs were less resistant to submergence. An increase in the incubation period occurred in fairly direct proportion to the period of submergence. A number of eggs hatched after being submerged continuously for 23 hours out of each 24 during the period of incubation.

DECKER (G. C.) & ANDRE (F.). **Studies on Temperature and Moisture as Factors influencing Winter Mortality in Adult Chinch Bugs.**—*Iowa St. Coll. J. Sci* **10** no. 4 pp. 403–420, 8 figs., 7 refs. Ames, Iowa, July 1936. [Recd. December 1936.]

The following is substantially the authors' summary and discussion. Adults of *Blissus leucopterus*, Say, collected from 3 different localities in Iowa, and those collected from the same locality at different times during the winter, varied in their resistance to cold. When the bugs were exposed for a long period at a constant temperature of —12·2 or —17·7°C. [10·04 or 0·14°F.], the percentage of mortality increased rapidly for about the first 10 hours and after that the increase was less rapid. Precooling at sublethal temperatures increased resistance to temperatures between —7 and —15°C. [19·4 and 5°F.], but the mortality resulting from exposures to lower temperatures was not significantly different from that obtained by instant exposures. When the temperatures were lowered by steps, there was a definite increase in resistance to fairly low temperatures (—7 to —12°C. [19·4 to 10·4°F.]), but this effect was gradually overcome as the exposure was prolonged. Dehydration by brief exposure at low relative humidities increased resistance, and bugs that drank water

were less resistant to low temperatures than those that did not. At 0°C. [32°F.], those kept at high relative humidities lived longer and lost less weight than those kept at low ones. Submergence in water at 0°C. resulted in 60 per cent. mortality after 22 days. Freezing in solid ice proved fatal in most instances.

The data presented show that the ability of chinch bugs to withstand freezing temperatures is comparatively low, and that the minimum temperatures usually recorded for Iowa and other States in the Maize Belt are normally low enough to kill practically all unprotected overwintering bugs. Under field conditions, the insulation afforded by an accumulation of dead grass, leaf mulch and snow cover is therefore of importance in reducing winter mortality. That insulation modifies the effect of freezing temperatures has been previously demonstrated by workers dealing with other insects [*cf. R.A.E.*, A **20** 691].

The formation of an ice sheet usually kills the bugs frozen into the solid ice, but those below the ice sheet may be affected in one of two ways. If the water below the ice drains away, insects in the turf below may benefit by the formation of the dead air space above them ; but if water fills all or most of the air spaces in the leaf mulch or other natural protection and then freezes into ice, the insulating value of the mulch may be greatly reduced.

DAVIS (R.) & HARRIS (H. M.). **The Biology of *Pseudosinella violenta* (Folsom), with some Effects of Temperature and Humidity on its Life Stages (Collembola : Entomobryidae).**—*Iowa St. Coll. J. Sci.* **10** no. 4 pp. 421–429, 1 pl., 6 figs., 10 refs. Ames, Iowa, July 1936. [Recd. December 1936.]

In this paper are described the results of observations on the biology of *Pseudosinella violenta*, Fols., which is common in Iowa under rocks, logs and rotting leaves, in ants' nests and in greenhouses in which the soil is moist. This springtail has been found to cause damage to the roots of sugar-cane in Louisiana [*R.A.E.*, A **18** 168, 678 ; **19** 675 ; **21** 654]. In experiments on its rate of multiplication, Ingram [**19** 675] observed that it fed on a fungus growing on dried ground-nuts. In the authors' experiments, ground-nuts were at first pitted and eventually consumed, but if any part of them was covered with fungus it was left untouched. The following is taken largely from their summary : A special technique is described for handling the small soft-bodied insects. A modified aspirator was used. Observations showed that they sheltered as readily under pieces of cover slips as under leaves or soil, suggesting that thigmotropic and not phototropic reactions were involved. Of 100 individuals examined, 70 were females. Pairing was not observed. Individuals were seen to " graze " on the surface moisture of hatching or moulting nymphs. There were 6 nymphal instars.

Experiments showed that a temperature of 30°C. [86°F.] and a relative humidity of 100 per cent. were the most favourable for hatching and development. Under these conditions, the egg and nymphal stages lasted 5 and 10½ days, respectively. When the eggs were placed in low relative humidities for 5 days and then removed to optimum conditions, the length of the egg stage was increased and the viability decreased. A relative humidity of 100 per cent. was the optimum for the adults.

OMAN (P. W.). **Distributional and synonymical Notes on the Beet Leafhopper,** *Eutettix tenellus* **(Baker).**—*Proc. ent. Soc. Wash.* **38** no. 7 pp. 164–165, 6 refs. Washington, D.C., October 1936.

Eutettix tenellus, Baker, has hitherto been recorded only from the western parts of the United States, Canada and Mexico, and from Florida, but the author finds that *Thamnotettix indivisus*, Haupt, which was described from Palestine, and *T. rubicundulus*, Van Duzee, which was described from Jamaica and also occurs in Porto Rico, are synonyms of it. He considers that the species is more closely related to *Thamnotettix* than to *Eutettix*, but retains it in the latter genus to avoid changing a name repeatedly used in the literature.

EICHMANN (R. D.). **The Cherry Aphid and Cherry Maggot of the Flathead Valley.**—*Bull. Mont. agric. Exp. Sta.* no. 313, 11 pp., 4 figs. Bozeman, Mont., March 1936. [Recd. December 1936.]

An account is given of the bionomics and control of *Myzus cerasi*, F. (cherry aphis) and *Rhagoletis fausta*, O. S. (black-bodied cherry fruit-fly), which have become major pests in a district in north-west Montana where the cultivation of cherries has recently been established.

M. cerasi is particularly injurious to young trees ; the leaves of the terminal shoots on which it feeds curl up and become coated with honey-dew, and finally twisted and stunted twigs and branches are produced. The winter eggs are laid in cracks of parts of the tree that are 2 or more years old and hatch in early spring when the buds swell. The young Aphids, which migrate at once to the buds and crawl into them as they open, mature in about a month. Several parthenogenetic generations are produced on cherry, of which the first four consist exclusively of wingless Aphids. During their development, the Aphids migrate about the tree and even crawl along the ground to infest new trees ; ants assist in this spread. Many individuals of the fifth and following generations are winged, and, though wingless forms are still produced, they gradually disappear from the cherry trees as the summer advances. The winged forms fly to some alternate food-plant, but its identity in this district has not been determined [*cf. R.A.E.*, A **6** 103, 441]. In the late autumn, winged males and gynoparae return to the nearly leafless cherry trees. The wingless female offspring of the gynoparae pair with the males and then deposit the winter eggs.

Sprays should be applied when the cherry buds are opening [*cf.* **23** 657]. In experiments in 1935, a spray of $\frac{3}{4}$ pint nicotine sulphate and $2\frac{1}{2}$ gals. summer oil emulsion in $97\frac{1}{2}$ gals. water completely controlled the Aphid on 992 trees out of 994 that were sprayed. When the nicotine sulphate was omitted, 36 out of 603 trees were left infested. Nicotine sulphate with soap is still being used satisfactorily, but is less effective than with oil.

Adults of *R. fausta* emerge over a period of about a fortnight, beginning when the fruits of the early varieties of cherries are colouring. Sour varieties are preferred, but infestation of sweet cherries also occurs to a slight extent. The eggs are laid just beneath the surface of the cherries and hatch in about a week. The larvae feed for about 3 weeks and then drop from the fruits and pupate in the soil. One or two winters are passed in the pupal stage. As the flies have a definite pre-oviposition period of several days, during which

they suck up drops of dew, they may be controlled by sprays. An average infestation of 2·63 per cent. in a sour cherry orchard was reduced to 0·61 and 1·5 per cent. on trees sprayed with lead arsenate at the rate of 8 and 4 oz., respectively, in 10 U.S. gals. water. The addition of molasses reduced the control. A spray of 8 oz. barium fluosilicate in 10 U.S. gals. water reduced the infestation to 0·97 per cent., and when, owing to rains or to the protracted emergence of the flies, several applications are necessary, this should be substituted for lead arsenate to obviate the problem of residues [*cf.* **23** 325]. Lime-sulphur appears to act as a deterrent and should not be used in combination with other sprays. The time of emergence of the flies should be determined by traps placed on the ground under previously infested trees. A spray should be applied as soon as they appear, and repeated at intervals of 7 to 10 days for as long as emergence continues. All foliage in the immediate vicinity of the cherry trees should also be treated.

In 1934, 4 per cent. of the larvae of *R. fausta* in pin cherries (*Prunus pennsylvanica*) were parasitised by *Tetrastichus* sp., and the parasite was also found in some of those in the sour cherries in 1935.

Pepper (J. H.) & Mills (H. B.). **The Virginia Creeper Leaf-hopper.**—*Bull. Mont. agric. Exp. Sta.* no. 314, 4 pp., 1 fig. Bozeman, Mont., March 1936. [Recd. December 1936.]

For the past 10 years, severe injury has been caused to Virginia creeper [*Parthenocissus quinquefolia*] in Montana by *Erythroneura ziczac*, Walsh, which was first found in the State in 1907 and has recently been very abundant. The distribution in North America is briefly discussed, and all stages are described. The adults, which hibernate under matted vegetation and débris, emerge in spring and begin feeding on Virginia creeper as soon as the buds commence to develop. They cause the leaves to become spotted with grey and sometimes completely defoliate the plant. The eggs are inserted in the lower surface of the leaf, between the larger veins, in groups of 1–10 ; more than 200 have been found on a single leaflet. In 1935, the first were observed on 26th June and the first nymphs on 12th July. Nymphs were most numerous at the end of July and beginning of August. Second generation eggs increased in numbers from 30th August to 27th September, and nymphs from 9th to 27th September. It is thought that few complete their development, most of the hibernating adults probably belonging to the first generation. Eggs and nymphs are killed by frost.

Excellent control was obtained by thoroughly spraying both surfaces of the leaves, shortly after the appearance of the first nymphs, with a mixture of $1\frac{2}{3}$ oz. nicotine sulphate, 8 oz. summer oil emulsion and 5 U.S. gals. water. Fairly satisfactory results were obtained when 5 oz. soap flakes were substituted for the oil emulsion.

Cassil (C. C.) & Smith (C. M.). **Lead Content of Chewing Tobaccos and Snuffs.**—*Amer. J. publ. Hlth* **26** no. 9 pp. 901–904, 6 refs. New York, September 1936.

Since lead arsenate is used extensively in the United States to protect growing tobacco from damage by insects, a method for the determination of lead in tobacco has been worked out and is here

described in detail. A recovery of about 90 per cent. is obtained. The procedure has been applied to 7 samples of snuff and 9 of chewing tobaccos. The amount of lead in grains per lb. ranged from 0·025 to 0·61 in the chewing tobaccos and from 0·088 to 0·935 in the snuffs. The corresponding figures for arsenic trioxide were 0·029–0·261 and 0·035–0·364.

CLARK (E. P.). **The Occurrence of Quebrachite in the Stems of** *Haplophyton cimicidum.*—*J. Amer. chem. Soc.* **58** pt. 6 pp. 1009–1010, 1 ref. Easton, Pa, June 1936. [Recd. December 1936.]

In an attempt to isolate the insecticidal material reputed to be present in the stems of *Haplophyton cimicidum*, a crystalline material was obtained, which proved to be quebrachite (1-methyl inosite). The method employed is described.

DRAIN (B. D.). **Pyrethrum in Tennessee.**—*Circ. Tenn. agric. Exp. Sta.* no. 59, 4 pp., 4 figs. Knoxville, Tenn., September 1936.

Vegetative strains of pyrethrum have been isolated, tested and propagated in Tennessee during the last 5 years. Methods of cultivating, gathering and drying the crop are described. Nine selections are now available that have produced blossoms yielding over 1·5 per cent. pyrethrins I and II. The usual seedling crop yields 0·9–1 per cent. total pyrethrins. The best crops were obtained from plants grown on sloping fertile soil, with good surface drainage. A fairly high elevation is desirable [*cf. R.A.E.*, A **25** 84]. Plants grown from seed produce a variable crop. Plants divided in October, and kept in cold frames until March, were the most satisfactory.

MUNRO (J. A.). **Grasshoppers and agricultural Development in North Dakota.**—*J. econ. Ent.* **29** no. 5 pp. 813–820, 11 refs. Menasha, Wis., October 1936.

The history of grasshopper infestation in North Dakota from 1851 to 1935 is reviewed. Efforts made between 1931 and 1934 to obtain control by means of poison baits are described and their value is demonstrated [*cf. R.A.E.*, A **24** 490]. Before 1880, less than 0·6 per cent. of the area was improved land in farms. In 1930, such land occupied 61·7 per cent. of the area of the State. The seriousness of infestation in the last few years has shown that the cultivation does not lessen grasshopper abundance but rather the reverse, as it provides food in greater quantity. *Melanoplus mexicanus*, Sauss., oviposits as readily in cultivated fields as in sod land. Other species, including *M. bivittatus*, Say, *Camnula pellucida*, Scudd., and *M. differentialis*, Thos., prefer to oviposit in grassy places near cultivated crops, but the hoppers move to the cultivated land to feed.

BREAKEY (E. P.) & MILLER (A. C.). **Halowax (Chlorinated Naphthalene) as an Ovicide for Codling Moth and Oriental Fruit Moth.**—*J. econ. Ent.* **29** no. 5 pp. 820–826, 8 refs. Menasha, Wis., October 1936.

Studies to determine the practical use of Halowax, a chlorinated naphthalene [*R.A.E.*, A **23** 457], against the eggs of the codling

moth [*Cydia pomonella*, L.] and the oriental fruit moth [*Cydia molesta*, Busck] were made under conditions between those of laboratory and field. Larvae of both species were collected in the autumn, held in cold storage, and removed as required during the following season. Batches of the resultant adults were liberated in wire gauze cages, 1 ft. high, covering apple or pear seedlings in 6-inch pots. Moisture was provided by squares of cellu-cotton batting soaked in water and placed on top of the cages. The moths, which at first showed a tendency to deposit their eggs on the stem near the level of the soil, were induced to oviposit on the foliage by means of a ring of opaque paper cutting off the bottom of the cage. The trees were sprayed when the age of the eggs on them varied from 1 to 4 days, and the eggs were counted 10 days later. The emulsions for spraying were prepared with a sulphonated fatty alcohol, used at 2 per cent. in the concentrate, and contained 80 per cent., by weight, white oil or oil and Halowax mixture. The sprays prepared from them contained 1 per cent. oil or mixture. Of the 15,063 eggs of *C. molesta* used, 1,856 were in 13 checks, where the average mortality was 3·3 per cent. Of the 7,344 eggs of *C. pomonella*, 1,500 were in 13 checks, where the average mortality was 5·5 per cent. There was no apparent difference in the susceptibility of eggs of the two species or of different ages. When the Halowax and oil with a viscosity of 80 seconds Saybolt were used in the proportion of 1 : 2, the mortality obtained was 87–96 per cent. Oil with a viscosity of 80 seconds appeared to be the best for use with Halowax, which gave only 0–1 per cent. mortality in combination with oil with a viscosity of 30 seconds. The effect of varying the ratio of Halowax to oil was studied. Ratios as low as 1 : 7 were quite effective (79–97 per cent. mortality), and the results less erratic than when oil alone was used (37–68 per cent.). It was not determined how much lower the ratios could have been carried. Earlier work had demonstrated that the choice of the emulsifier considerably affects the ovicidal powers of the spray and the degree of plant injury. Also the proportion of emulsifier has a bearing on the results obtained, an increased percentage reducing the effectiveness of the spray.

Burkholder (C. L.) & Ford (O. W.). **Comparative Methods of removing Lead Loads resulting from a heavy first-brood Oil-lead Schedule.**—*J. econ. Ent.* **29** no. 5 pp. 827–830. Menasha, Wis., October 1936.

Apples sprayed with lead arsenate and oil against the first and second broods of the codling moth [*Cydia pomonella*, L.] in Indiana in 1924 had proved difficult to clean of residue. In 1935, therefore, it was decided to test 6 first-brood cover sprays, all but the first containing 4 lb. lead arsenate and ½ per cent. summer oil [per 100 U.S. gals.], with the addition, in the case of half of the orchard, of ½ lb. soap, and to use lead arsenate in Bordeaux mixture against the second brood. After the 6th spray at the beginning of July, however, no more sprays were applied, as injury to the foliage would probably have resulted. The addition of soap increased the residue at harvest of both lead and arsenic. The greater part of the residue removal was done with an underbrush-flood washer, as this is the type that has been extensively installed in packing sheds in Indiana during 1934 and 1935, and is known to give a better percentage of removal than the flotation type. The tests were made on two varieties of apple.

Increasing the time of exposure above 20 seconds only slightly increased removal. Raising the temperature of the washing solution was more satisfactory ; the percentages of lead removed from the two varieties by 1½ per cent. hydrochloric acid were 86 and 75 at 67°F. and 92 and 85 at 100°. Delay between picking and washing or abnormally low shed temperatures increase the difficulties of residue removal and necessitate the use of heating equipment. In 1934, Vatsol with cold as well as hot acid increased removal, but in 1935, in treatments made within 36 hours of picking, it did not definitely increase the lead removal in underbrush-washing, when used at ⅛ and ¾ per cent. with cold 1½ per cent. acid. When ¾ per cent. Vatsol was used with 2¼ per cent. acid, there was a considerable increase over other cold treatments in the amount of lead removed from one only of the two varieties used in the tests. In previous work, raising the acid strength over 1½ per cent. had increased removal very slightly. When used with hot 1½ per cent. acid, ⅛ per cent. Vatsol did not increase removal, but ¾ per cent. gave a better percentage of removal, which was not improved by raising the acid strength to 2¼ per cent.

Elmore (J. C.) & Campbell (R. E.). **Attraction of Cucumber Beetles to the Buffalo Gourd.**—*J. econ. Ent.* **29** no. 5 pp. 830–833, 3 refs. Menasha, Wis., October 1936.

In view of the fact that adults of *Diabrotica* spp. have been observed to be attracted to injured plants and fruits of the buffalo or wild gourd (*Cucurbita foetidissima*), experiments on its effectiveness as a bait were carried out in California in July and August 1934. It was ascertained that the comparative attractiveness of crushed stems, leaves, roots and fruit varies directly with the available moisture content of the part. The leaves and stems were more attractive at first, but dried more quickly than the fruit and roots, which were more attractive on the second day of the tests. The respective numbers of adults of *Diabrotica trivittata*, Mann., *D. soror*, Lec., and *D. balteata*, Lec., taken in 24 hours, in 32 plates containing one U.S. pint of crushed bait (8 plates of each plant part), distributed over a field of squash 80 ft. sq., were 274, 221 and 0 on leaves, 699, 135 and 3 on stems, 191, 197 and 13 on roots, and 336, 234 and 4 on fruit. *D. balteata* had not been previously observed in the field, which was known to be infested with the other two species. A water extract of the stems and leaves distributed in 6 traps caught 1,150 *D. soror*, 390 *D. trivittata* and 41 *D. balteata* in 7 days. In experiments in another district where *D. soror* and *D. balteata* were predominant, 8 baits composed of leaves, stems and fruit ground together and exposed for 2½ hours in the middle of the day attracted 221 *D. soror*, 250 *D. balteata*, and 14 *D. trivittata*.

Various types of trap in which it was tried to confine the beetles attracted to the bait proved unsuccessful. An eloctrocuting trap was also a complete failure. The addition of either Paris green or sodium fluosilicate repelled the beetles that had been attracted to the vicinity by the smell of the baits.

Emery (W. T.). **Chinch Bug Flights.**—*J. econ. Ent.* **29** no. 5 pp. 833–837, 2 figs., 2 refs. Menasha, Wis., October 1936.

The following is the author's summary of investigations made in Kansas in 1935 on the factors governing the flight of the chinch bug

[*Blissus leucopterus*, Say]: Data obtained from flight screens in connection with sod and air temperatures, made by thermocouple bulb and thermograph respectively, show that when chinch bugs migrate from winter quarters their flights are governed largely by changes in temperature. Flights from places of hibernation occur in spring when the temperature of the sod in which the bugs are hibernating reaches 60°F. Redistribution flights occur late in the spring and during the summer when air temperatures fall below 60°F. and then rise distinctly above that temperature. Flights to places of hibernation occur in the autumn after drops in temperature corresponding to the temperature increases observed in the spring. In spring, migrating chinch bugs stop at the margins of grain fields, or as soon as they have reached an attractive food-supply.

Smith (R. H.) & LaDue (J. P.). **Blood Albumin Spreader used with Oil Sprays.**—*J. econ. Ent.* **29** no. 5 pp. 838–842, 4 refs. Menasha, Wis., October 1936.

Investigations on powdered blood albumen as a spreader for oil sprays were made in California in 1934 and 1935. The specifications for the spreader require 1 part powdered blood albumen to 3 parts fuller's earth or some similar substance (which is necessary to make the albumen wet readily), the albumen to be not less than 96 per cent. water-soluble with moisture content less than 6 per cent., and 90 per cent. or more to pass through a 100-mesh screen. Data obtained during the experiments indicate that the maximum moisture content should be 8 or 9 per cent. rather than 6. The methods used for determining the amount of moisture and the proportion of soluble solids in blood albumen spreader are described in detail. Analyses of 14 samples of blood albumen received from manufacturers showed that the proportion of soluble solids was 95·78–99·91 per cent. and the moisture content 6·45–9·52 per cent. with an average of 8·03. A 15 lb. shipment, that contained 97·95 per cent. soluble solids and 8·82 per cent. moisture in January 1934, a year later contained 92·7 and 8·95 per cent. An investigation into the influence of the kind of earth on the quality was made with spreaders supplied by 5 manufacturers and others prepared in the laboratory with earths identical with those used in these spreaders. The sprays were made up of 1½ U.S. gals. oil and 4 oz. spreader to 100 U.S. gals., and there was no significant difference in oil deposit attributable to the different kinds of earth, though they appeared to have different capacities for adsorbing the albumen. After being stored for a year, the solubility of the samples prepared in the laboratory had decreased by 1·1 per cent. and that of the samples supplied by manufacturers by 1·28 per cent. There appeared to be no definite correlation between the decrease in solubility and the moisture present in the earths. The keeping quality of all samples appeared to be satisfactory.

Lane (M. C.) & Jones (E. W.). **Flooding as a Means of reducing Wireworm Infestations.**—*J. econ. ent.* **29** no. 5 pp. 842–850, 4 figs., 9 refs. Menasha, Wis., October 1936.

An account is given of investigations conducted in 1932–34 on flooding considered in conjunction with soil temperature as a means of controlling wireworms in the north-western United States. Previous investigations into the possibilities of flooding are discussed

from the literature, but in none of them was temperature taken into account.

The wireworms concerned in these tests were *Pheletes californicus*, Mann., and *P.* (*Limonius*) *canus*, Lec. No significant differences were noted in the reactions to submergence of the two species or of the various larval instars, all of which were included. Groups of 20 larvae, placed individually in vials of water, open at the top, and kept at a constant temperature, were killed in 27 days at 86°F., in 30 days at 81·5°, and in an increasing time at decreasing temperatures, until at 50–59° some survived for over a year. The larvae did not survive so long in vials half full of soil and filled up with water, being killed in 4 days at 86°F., in 5 days at 81·5°, in 7 days at 77°, in 9 days at 72·5°, and in 12 days at 68°. Temperatures of 50–59°F. caused 26 per cent. mortality in 21 days. Groups of 10 adults in soil under water in vials were killed in 7 days at 77°F. or above, and 14 days at 68°, but only 30 per cent. were killed in 14 days at 59°. There was practically no mortality among larvae kept singly in test tubes under damp soil for the duration of the experiments. The longer survival in water alone than in water and soil may be due to oxygen deficiency and carbon dioxide accumulation at high temperatures in the latter, or the taking in of soil salts with the water.

The first field tests were carried out in soil cages, 4 ft. wide, 10 ft. long and 18 ins. deep, fully exposed to the sun. The cages were of galvanised iron and were sunk so that the top was level with the surface of the ground. A thin layer of porous cement was poured over the soil at the bottom. The cages were filled with sterilised soil. Large numbers of wireworms were placed in it at depths of 3, 6, 9 and 12 ins., and the cages were flooded with water, which was kept at a level of 2 ins. above the surface of the soil. Soil temperatures at three depths under the water were obtained with a recording thermometer, and air temperatures in the shade 4 ft. above the water from a thermograph. In 7 days' flooding, with mean soil temperatures of 69·9° and 73·3°F., 93·5 and 98·7 per cent. of the larvae were killed. In 4 days at 75° and 75·4°, 87·5 and 92·5 per cent. were killed. Mean soil temperatures of 73·1–75·8° killed only 18–23·3 per cent. in 1 day. Tests on a larger scale were carried out in plots of ploughed, levelled and dyked land, in which the water was maintained at a depth not exceeding 3 ins. above the soil. The wireworm populations were ascertained by washing soil samples 3 ins. sq. and 1 ft. deep before and after flooding. At soil temperatures of 75–77·9°, 94·5–100 per cent. of the larvae were killed in 7 days. The reduction in mortality that occurred when the temperature was lower was only partly offset by increasing the period of flooding. Flooding in autumn for 24 days when the soil temperature was 67·5° killed only 33·3 per cent. of the larvae, though the adult population was reduced by 71 per cent.

Richardson (C. H.), Craig (L. C.) & Hansberry (T. R.). **Toxic Action of Nicotines, Nornicotines and Anabasine upon** *Aphis rumicis* **L.**—*J. econ. Ent.* **29** no. 5 pp. 850–855, 5 figs., 15 refs. Menasha, Wis., October 1936.

In continuation of a study of N-heterocyclic compounds [*R.A.E.*, A **23** 5], the toxicity of *dl*-β-nornicotine, *dl*-α-nicotine and *dl*-α-nornicotine, which have not previously been examined for their action on insects, was compared with that of *dl*-β-nicotine (racemic

nicotine), anabasine (*l*-β-pyridyl-α-piperidine) and *l*-β-nicotine (natural nicotine) in 1934 and 1935.

The following is based on the authors' summary : The solutions of the bases in 0·25 per cent. sodium oleate solution were applied in a fine spray to adult, wingless, agamic females of *Aphis rumicis*, L., under standardised conditions. Among checks sprayed with 0·25 per cent. sodium oleate solution, mortality was 10–23·3 per cent. The order of toxicity of the bases, with the concentrations in mg. per 100 cc. of solution necessary to produce 50 per cent. mortality, was : Anabasine (5), *l*-β-nicotine (49), *dl*-β-nornicotine (45), *dl*-β-nicotine (96), *dl*-α-nicotine (1,496) and *dl*-α-nornicotine (1,514). The presence or absence of a methyl group on the pyrrolidine nitrogen of a pyridyl pyrrolidine is not essential for the toxic action of the compound to *A. rumicis*, but this is not true for certain vertebrates and may not be true for other insects. The compounds with linkage at the β-position of the pyridine nucleus are the most toxic in this series, as they have previously been found to be in the pyridyl piperidine series. This relation between the β-position and toxicity in these pyridine derivations may prove to be fairly general. Racemic nicotine is about one-half as toxic as natural nicotine, the *laevo* fraction probably being largely responsible for its action on the Aphid. Anabasine is considerably more toxic [*cf.* **23** 552] than the other compounds studied in this investigation, and it is probably somewhat more toxic than neonicotine (*dl*-β-pyridyl-α-piperidine) [**19** 100]. M. Ehrenstein (*Arch. Pharm., Berl.* **269** 627–659) claims to have found the optical isomer, *l*-β-nornicotine, in tobacco, and possibly it will be discovered in other plants.

Ginsburg (J. M.) & Cavallito (C. J.). **Arsenical Substitutes. II. Some Relationship between molecular Structure and Toxicity of Organic Compounds to the Silkworm,** *Bombyx mori.*—*J. econ. Ent.* **29** no. 5 pp. 856–859, 1 ref. Menasha, Wis., October 1936.

The effectiveness as stomach poisons of 121 organic compounds, mostly benzene derivatives and all insoluble in water, was tested on third-instar larvae of *Bombyx mori*, L., by a dust method [*R.A.E.*, A **23** 454]. The dusts were composed of the chemical and kaolin in the proportion of 1 : 9 by weight. A lead arsenate dust used as a check caused 100 per cent. mortality in 3 days. The experiments were repeated several times with the substances that appeared to be toxic. Toxicity was shown by only 26 compounds, of which 7 caused over 55 per cent. mortality after 3 days. Phenothiazine, thioacetanilide, d-camphor oxime, methyl undecyl ketone, dephenyl nitrosoamine, p-nitrophenetole and dimethyl glyoxime caused 100, 95, 90, 90, 75, 63 and 55 per cent. mortality respectively. Of these, 6 contain nitrogen groups, and the 2 most toxic contain nitrogen and sulphur in the molecule, in the form of amino- and thio- groups respectively. A list is given of all the compounds used, with the mortality caused by them, if any.

Eckert (J. E.) & Allinger (H. W.). **Relation of Airplane Dusting to Beekeeping.**—*J. econ. Ent.* **29** no. 5 pp. 885–895, 3 figs., 5 refs. Menasha, Wis., October 1936.

In this paper, the authors discuss the poisoning of bees in northern California by drifts of calcium arsenate dust applied by aeroplane to

fields of tomato [*cf. R.A.E.*, A **23** 527]. During 1935, it was observed that the amount of drift increased with the height at which the poison was released, and that, although the aeroplane usually flew at 5–15 ft. above the plants, the pilot generally opened the dust compartment on approaching the field, when still 30 ft. or more above the ground, and seldom shut it before the plane had risen sharply on leaving the field. This resulted in the release of dust over residential areas, where it endangered human health, and over crops intended as food for livestock, as well as over blossoms visited by bees. The dusts remained low when the temperature was below 56°F., but rose rapidly at temperatures above 60°. From an observation, it appeared that less than half of the dust released ever reached the plants or the ground on which they were growing. Analyses showed the presence of 10–30 parts arsenic per million in 9 samples of bees, brood and pollen, and 6–14 parts per million in wild flowers gathered one mile from a treated field. Sugar-beet tops taken 100 ft. from a dusted field yielded 1,420 parts arsenic per million. The lethal dose for a bee is 0·5 part per million. The exposure of greased plates showed that only small amounts of poison can be expected to adhere to the undersides of leaves and fruits and that large amounts drift from the field. In an apiary ¾ mile from a treated field, 2 plates received sufficient arsenic to kill a large number of bees. Some colonies of bees were more seriously affected than others, with no appreciable difference between closed ones and others that had been left open. Many colonies and nuclei had been reduced by at least 50 per cent., 13 days after dusting was begun. Much loss was sustained in apiaries situated 1·75–2·5 miles from the nearest field dusted with calcium arsenate [*cf.* **23** 299]. Honey production was seriously affected but, as in 1934, queen bees were apparently uninjured.

Section of Extension Entomology.—*J. econ. Ent.* **29** no. 5 pp. 904–923, 3 figs. Menasha, Wis., October 1936.

The papers in this section include two on the control of Tettigoniids. Most of the information contained in the first, which is entitled Fighting Mormon Crickets (pp. 904–908), by C. Wakeland, has already been noticed [*R.A.E.*, A **24** 334]. It is estimated that 22,023 acres of crop were attacked by *Anabrus simplex*, Hald. (Mormon cricket) in Idaho in 1935, and that 13,162 lb. sodium arsenite and 53,148 lb. hydrated lime, applied in 29,991 man-hours to 9,729 acres of crop and range land, at a cost of about £5,000, protected 113,099 acres.

In Cricket Control in Washington (pp. 916–918), I. W. Bales describes the measures taken against the present outbreak of *Peranabrus scabricollis*, Thomas (Coulee cricket), which caused serious losses during 1934 and 1935, and *Anabrus simplex*, which became injurious in 1933 and, at the close of the 1935 season, infested 48,640 acres of cultivated land, principally wheat, and 147,040 of range land. One band of *A. simplex*, extending over a front of 2 miles, destroyed 66 per cent. of the crop in a 400-acre field in 4 days. Metal barriers, 12–18 ins. high, were effective but expensive. Trenches, 18-24 ins deep, were effective where the soil was sandy. The control obtained by burning natural vegetation did not warrant the loss of pasture. A bait consisting of 120 lb. bran, 25 lb. sawdust, 7 U.S. qts. sodium arsenite, 2 U.S. gals. molasses, 5 oz. amyl acetate and 8 lb. salt was used with varying success. A dust of sodium arsenite and hydrated

lime (1 lb. to 4 lb.) was extensively used, but the substitution of an equal volume (2 lb.) of diatomaceous earth for the lime resulted in better dispersal and quicker kill. In experimental cages, 100 per cent. kill was obtained with 2 lb. sodium arsenite to 5 lb. earth. Mortality is increasingly rapid at temperatures over 90°F.

GADDIS (B. M.). **Eradication of Citrus Canker and Control of Phony Peach and Peach Mosaic. Progress Report.**—*J. econ. Ent.* **29** no. 5 pp. 940–944. Menasha, Wis., October 1936.

It is thought that the peach borer [*Aegeria exitiosa*, Say] may be a vector of the virus of phony peach disease, which is widely distributed in the south-east of the United States. Investigations in progress during 1936 should give a fairly definite indication as to whether this is so. The most important of the control measures now adopted is the removal of diseased trees from the neighbourhood of nurseries in the infected area and of all plants infested with the borer from nursery stock.

CHAMBERS (E. L.). **European Corn Borer Situation in Wisconsin.**—*J. econ. Ent.* **29** no. 5 pp. 944–947. Menasha, Wis., October 1936.

Notes are given on the history of the European corn borer [*Pyrausta nubilalis*, Hb.] in Wisconsin [*R.A.E.*, A **21** 454; **24** 559]. In 1935, infestations were found in 133 fields in 12 counties. Adult females had apparently been carried across Lake Michigan in boats. Although there is a certain amount of spread by flight, a quarantine is considered to be justified. It is thought that this prevented spread into Wisconsin in 1932 and 1933 when, owing to drought, maize would otherwise have been imported from the infested eastern States. A State quarantine was maintained before the Federal quarantine was established, and was put into force again when the latter was repealed [*R.A.E.*, A **20** 648]. The extensive use of silos facilitates the early and complete removal of débris from the fields each year, and this checks the spread of isolated infestations.

GATES (L. M.). **Recent Developments in regard to Alfalfa Weevil.**—*J. econ. Ent.* **29** no. 5 pp. 947–953, 9 refs. Menasha, Wis., October 1936.

In view of the fact that *Hypera variabilis*, Hbst. (*postica*, Gyll.) can be successfully controlled and is doing very little damage to lucerne in the United States, attention is called to some of the more important published information [*R.A.E.*, A **13** 433; **23** 554, 555, etc.], which might lead to a decision as to whether quarantines, which are costly, inconvenient and ineffective [**16** 33; **23** 135], are necessary.

RIKER (A. J.). **Recent Developments in Control of Graft Knots on Nursery Apple Trees.**—*J. econ. Ent.* **29** no. 5 pp. 956–960, 5 figs., 2 refs. Menasha, Wis., October 1936.

Notes are given on three types of graft knot, one of which, hairy root (caused by *Phytomonas rhizogenes*), particularly important on apple grafts, is transmitted by root-chewing insects. Recommended control measures, tested in the central States, include the choice of soil relatively free from insects and the use of tape wrappers, which protect the grafts from attack by them.

PALM (C. E.). **Status of the Alfalfa Snout Beetle in New York.** *Brachyrhinus ligustici* **L.**—*J. econ. Ent.* **29** no. 5 pp. 960–965, 1 ref. Menasha, Wis., October 1936.

This is a report on the continuation of studies already noticed [*R.A.E.*, A **23** 465, 557] on *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., on lucerne and clover in New York. The weevil appears to be spreading slowly within the known limits of distribution in the State, 592 acres now being infested, but it was not found beyond these limits.

In 1935, the weevils began to work their way to the surface of the soil late in March, and first reached the surface on 11th April, but remained beneath débris until 21st April, when weather conditions became favourable for movement. Migration was at its height about 8th–10th May, after which it diminished rapidly, although a few individuals were moving as late as 10th June. The weevils took shelter during cold and wet weather, and moved almost exclusively during daylight. They fed voraciously on the foliage of a number of plants. On lucerne and clover, feeding was most pronounced during the first two weeks after emergence, although it continued through the egg-laying period. The weevils fed on any tender short growth, but much of the feeding was confined to the basal parts of the plant. After oviposition had begun, there was practically no lateral migration, except a secondary phase after the first cutting of the crop. In dispersion experiments, on ploughed land, some weevils travelled 230 yards in 10–14 days. It is not known how far they will migrate through lucerne. Oviposition was first noted in the field on 20th May, and the last date on which an egg was deposited by a weevil collected in the field was 8th September. Under insectary conditions, oviposition lasted from 21st May until 31st July. Unfed weevils and others that had fed lightly on orchard grass and timothy [*Phleum pratense*] deposited no eggs. In a well drained area, pupation began on 18th June and was complete by 18th July, and transformation to adults began on 10th July. In heavy, wet soil, the first pupae were obtained on 15th July and the last on 3rd September. Variation in soil temperature affects the rate of pupation.

In addition to lucerne and clovers, larvae are being reared on a wide variety of plants, including cabbage, chicory (*Cichorium intybus*), maize and raspberry. Of 83 partly mature larvae of the 1934 brood collected from 17th July to 14th August 1935 and placed on 15 different food-plants, 29 were still alive on 31st October, and 5 had given rise to adults, having completed their feeding on soy-beans, *Agropyrum repens*, mullein [*Verbascum*] or dock (*Rumex*). It seems almost certain that, when the larvae take 2 years to develop, the life-cycle will last 3 years. The two-year life-cycle has been verified under experimental conditions. One adult was reared with dock as the larval food-plant, and it appears that dock is as satisfactory as lucerne as food for the larvae and adults. Adults that are carried into barns quickly leave in search of growing plants. The only danger of spread through cut lucerne seems to be local. There is greater danger of spread at the time of the spring migration, when adults may be carried considerable distances on vehicles.

In experiments with possible control measures against adults in the preoviposition period, a straight-walled trench, 8–12 ins. deep, appeared to be the most economical and effective barrier, if the sides were dry and free from grass roots. Trap holes in the bottom, at 15–25 ft.

intervals, collected the weevils. The following materials, given in descending order of effectiveness, were laid as strip barriers along the surface of the ground : crude chipped naphthalene, creosote, drained motor oil with crude chipped naphthalene in suspension (2 lb. per U.S. gal.), pine tar, and coarsely ground flowers of sulphur. None prevented migration when large numbers of weevils assembled along them. Trap holes on the front side increased their efficiency. Of several baits, the best was one composed of soaked raisins, shorts and sodium fluosilicate [**19** 528], which gave 78·5–98·9 per cent. mortality in growing lucerne and 83·7–98·8 per cent. in ploughed fields. The minimum effective rate of application has not been determined, but 100 lb. per acre is excessive. Of the sprays tested, which included lead arsenate, zinc arsenite and cryolite, calcium arsenate (2½ lb. to 50 U.S. gals. with 2½ lb. hydrated lime and 1 lb. soap) gave the best results on foliage of clover and lucerne. It is necessary for insecticides to cover the base of the shoots of lucerne. Dusts of calcium arsenate and hydrated lime or finely ground dusting sulphur (1 : 1) on lucerne and clover gave very encouraging results. Infested lucerne fields that were ploughed in the autumn and harrowed before the middle of April contained practically no living vegetation on the surface at the time of emergence. Weevils emerging from these areas were consequently obliged to migrate for food, and for this reason poisoned baits were particularly effective in such fields. Fields that were ploughed in April contained scattered vegetation, which afforded shelter and food. Maize is a safe crop to plant after the ploughing of infested lucerne.

Lyle (C.). **Challenge of the Argentine Ant.**—*J. econ. Ent.* **29** no. 5 pp. 965–967. Menasha, Wis., October 1936.

Attention is called to the gravity of the problem of the Argentine ant [*Iridomyrmex humilis*, Mayr] in the southern States and to the large sums being spent each year in individual efforts to control it. In one town in Mississippi with less than 2,000 inhabitants, it is estimated that some £700 is spent annually on ant poison. It is recommended that regular poisoning campaigns, such as are proving successful in Mississippi [*R.A.E.*, A **24** 770], should be carried out throughout the southern States, and that supplementary measures, including the destruction of colonies by oiling or burning, should be employed to hasten extermination.

Chamberlin (F. S.) & Morrill, jr. (A. W.). **Experiments to control Tobacco Budworm.**—*J. econ. Ent.* **29** no. 5 pp. 967–970, 1 fig., 2 refs. Menasha, Wis., October 1936.

In view of the high cost of lead arsenate and maize meal (1 : 75) applied to the buds of tobacco for the control of *Heliothis virescens*, F., in Florida and Georgia [*R.A.E.*, A **6** 214 ; **15** 628], the possibility of finding a substitute was investigated. Zinc ortho-arsenate, calcium arsenate, manganese arsenate, magnesium arsenate, sodium fluosilicate, pyrethrum, calcium fluosilicate, a sodium sulphur compound and derris were tested in various concentrations with maize meal as alternative insecticides. All the poisons were applied with the fingers, to cigar wrapper tobacco. The first two caused excessive foliage injury, and the others failed to control the larvae. Cotton-seed meal and cotton-seed meal siftings, as carriers for lead arsenate, injured the leaves by adhering

to the buds and preventing their expansion, and mixtures of lead arsenate with maize ear meal, maize bran siftings, wheat flour siftings, sand, wood ashes, hydrated lime, wheat bran siftings or tobacco dust failed to control the larvae.

MOZNETTE (G. F.). **Effectiveness of low Concentrations of Nicotine in Combination with other Materials against Black Pecan Aphid.**—*J. econ. Ent.* **29** no. 5 pp. 970–972. Menasha, Wis., October 1936.

During 1932, 1933 and 1934, low concentrations of nicotine sulphate in combination with other materials were tested in Georgia against *Melanocallis caryaefoliae*, Davis [*R.A.E.*, A **23** 485], in view of the large quantities of spray required to cover pecan trees, and the consequent high cost of controlling the Aphids. Nicotine sulphate at 1 : 4,000 gave 99·7 per cent. mortality when combined with Bordeaux mixture (6 : 8 : 100), 95·4 per cent. with weaker Bordeaux mixture (4 : 5 : 100), 95·2–99·4 per cent. with white oil emulsions (0·5 per cent.) and 91·9–99·6 per cent. with potassium oleate (4–6 lb. to 100 U.S. gals.), and at 1 : 5,000 with Bordeaux mixture (6 : 8 : 100) it gave 95·9 per cent. mortality. Variation in the actual oil content, viscosity and unsulphonated residue of the emulsions had only a slight influence on the effectiveness of the sprays. When the nicotine sulphate was used in combination with potash fish-oil soap, fish oil, resin potash fish-oil soap, liquid or powdered lignin pitch, calcium caseinate or pine-tar oil, the percentage mortality was low. At present prices, the use of nicotine sulphate at 1 : 4,000 as against 1 : 1,000 effects a saving of 50 per cent. when combined with Bordeaux mixture or white oil emulsion, and 37 per cent. with potassium oleate at 6 lb. per 100 U.S. gals.

REID, jr. (W. J.). **Relation of Fertilizers to Seed Corn Maggot Injury to Spinach Seedlings.**—*J. econ. Ent.* **29** no. 5 pp. 973–980, 1 fig., 2 refs. Menasha, Wis., October 1936.

It is estimated that during 1926, 1927, 1929 and 1930, *Phorbia* (*Hylemyia*) *cilicrura*, Rond. (seed corn maggot) caused a decrease of 23 per cent. in the yield of spinach [*cf. R.A.E.*, A **21** 611] in an area in South Carolina. In this district, spinach is susceptible to attack throughout the growing season, and particularly so in the seedling stage during November. The larvae rasp the tissues of any underground portion, and often tunnel into the hypocotyl, causing the seedlings to wilt and die. It was known that certain organic constituents of commercial fertilisers commonly used in spinach production attract the adults of *P. cilicrura*, encourage oviposition, and serve as food for the larvae, and also that fertiliser mixtures containing superphosphate prepared with sulphuric acid previously used in the preparation of petroleum products are less attractive than those prepared with unused acid. Fourteen field experiments were therefore conducted, during the 4 seasons from 1927 to 1931, on the relation of fertilisers to infestation. All the experiments were carried out on fine sandy loam. A mineral mixture, commercial fertilisers, and special fertilisers containing different proportions of organic materials (cotton-seed meal, fish scrap or meal, animal tankage and castor-bean meal) were applied to different plots shortly before the crop was planted. No fertiliser

was applied to the checks until the plants were sufficiently advanced to be thinned, when they received an all-mineral mixture. Except in the case of castor-bean meal, which is less attractive than the other substances, at least two of the organic ingredients were used in each of the mixtures. The proportion of organic and inorganic materials in the fertilisers was based on the ratio of available nitrogen furnished by the two classes of ingredients. Either 100, 50 or 0 per cent. of the nitrogen was furnished by inorganic materials, and the composition of the fertilisers was such that these 3 types of mixtures were approximately 0, 25, and 50 per cent. organic, respectively. None of the commercial fertilisers derived more than 50 per cent. of its nitrogen from organic materials, and about half of them contained superphosphates prepared from used sulphuric acid. The fertilisers were applied by hand at the rate of 1,000 lb. per acre during the first 3 seasons, and 750 lb. during the last season. Where no fertiliser was applied until after the seedling stage, the average yield was 4,544 lb. per acre. Where the fertilising mixtures applied were all-mineral, 25 per cent. organic containing superphosphate from used sulphuric acid, commercial, 25 per cent. organic containing superphosphate from ordinary acid, 25 per cent. organic with castor-bean meal as the only organic material, and 50 per cent. organic, the yields per acre were 3,794, 3,611, 3,497, 2,877, 2,676 and 2,316 lb., respectively. The plots that gave the highest yield also showed the lowest infestations by *P. cilicrura*. Mixing the fertiliser into the soil with greater thoroughness and to a depth of 6 instead of 3 ins. did not materially reduce infestation. With other factors equal, the most severe infestations occurred in soils containing considerable quantities of partly decayed vegetable matter.

Crumb (S. E.) & Chamberlin (F. S.). **Laboratory Tests on comparative Effectiveness of Fumigants against Cigarette Beetle in Cigars.**—*J. econ. Ent.* **29** no. 5 pp. 983–992, 1 fig., 4 refs. Menasha, Wis., October 1936.

This paper records the results of experiments carried out during 1927 and 1928 on the fumigation of cigars against *Lasioderma serricorne*, F. (cigarette beetle). Larvae and pupae were exposed to treatment as in experiments on sustained and dissipated vacuum [*R.A.E.*, A **21** 248]. The fumigation chambers and the method of introducing each fumigant are described. At atmospheric pressure, chloropicrin gave erratic control and under certain conditions left a disagreeable flavour ; a mixture of ethylene dichloride and carbon tetrachloride (3 : 1 by volume) and carbon tetrachloride alone were unsatisfactory and left a disagreeable flavour ; carbon bisulphide at dosages of 10, 8 and 6 lb. per 1,000 cu. ft. with exposures of 8, 15 and 24 hours, respectively, gave complete kill (except that 1 larva out of 419 survived fumigation with 8 lb. for 15 hours) and left no disagreeable odour or flavour, but is inflammable and explosive ; and liquid hydrocyanic acid produced a high mortality in 6 tests at 24 oz. per 1,000 cu. ft. with an exposure of 4 hours, but gave complete control only at 32 oz. with an exposure of 15–24 hours. A relatively small number of eggs included in this experiment were killed. A mixture of carbon bisulphide and carbon dioxide, introduced at low pressure, which was immediately raised to atmospheric pressure, gave relatively high kills, but, at a dosage of 50 lb. per 1,000 cu. ft. with an exposure of 4 hours and an

initial vacuum of 27 ins. failed to give a complete kill. Tested at sustained low pressure, chloropicrin gave erratic results and left a disagreeable flavour in the cigars, and liquid hydrocyanic acid at 7 oz. per 1,000 cu. ft. with an exposure of 2 hours gave 97·8 per cent. mortality of larvae and 95·6 of pupae, but it was necessary to increase the dosage to 48 oz. and the exposure to 4 hours to obtain consistent complete kills with a vacuum of 26 ins. No perceptible odour was left in the cigars Mortality among check larvae and pupae was 6·9 and 17·1 per cent., respectively. The tabulated results of the experiments show the temperature and humidity conditions prevailing during each.

Cockerham (K. L.) & Deen (O. T.). **Fumigating Sweet Potato Seed with PDB to control Sweet Potato Weevil.**—*J. econ. Ent.* **29** no. 5 pp. 992–1000, 5 figs., 4 refs. Menasha, Wis., October 1936.

Early work on fumigation of sweet potato tubers against *Cylas formicarius*, F., is briefly discussed from the literature. Tests with paradichlorobenzene against larvae, pupae and adults were begun in Mississippi in 1925. A bushel of heavily infested tubers was put into each of four 50 U.S. gal. oak barrels. In two of them, newspaper was placed over the tubers and 1 and 2 oz. paradichlorobenzene, respectively, was sprinkled over it, and the barrels were covered with oilcloth secured with hoops. In the other two barrels, the same quantities of paradichlorobenzene were sprinkled over a layer of pine needles replacing the newspaper, and covered with 6 ins. soil. The 4 treatments had killed all individuals after 28 days. There was no indication that rot or decay had increased. In a second series of experiments, conducted in a similar manner except that all the sweet potatoes were covered with pine needles and soil, 1 oz. and 2 oz. paradichlorobenzene over $\frac{1}{4}$ bushel tubers and 1 oz. and 4 oz. over 1 bushel gave 100 per cent. mortality in 22 days. When 4 oz. paradichlorobenzene was used, most of the tubers were rotten ; the other treatments left them uninjured. As all the tubers retained an objectionable odour for an indefinite period, all later tests were confined to seed tubes.

During 1933, 1934 and 1935, experiments were conducted with barrels, storage mounds and seed beds to determine minimum dosages and exposures and the effect of treatment upon sprouting. Either 50 lb. or 150 lb. sweet potatoes were placed in each barrel and covered with a 4-inch layer of pine needles. Paradichlorobenzene was evenly sprinkled over the needles and covered with 4 ins. soil. The barrels were protected from rain but not from other climatic conditions. The storage mounds, which resembled those in common use on farms, each contained 50 lb. sweet potatoes, covered with pine needles and 4 ins. soil. Before covering the top of the mounds, the required quantity of paradichlorobenzene was sprinkled on the pine needles and soil above the potatoes, and the mound was then completed. In each seed bed, and 50 lb. sweet potatoes were spread out and covered with 1 in. soil, and the paradichlorobenzene was sprinkled evenly over the bed and covered with a further 3 ins. soil. In each test, 4–10 lb. infested tubers were used, all of which were cut at the end of the fumigation period ; all weevils then found were placed in 4 oz. tin boxes on moist blotting paper and examined

daily for 72 hours to determine the percentage mortality. The uninfested tubers were planted to obtain sprouting records, those in seed-beds remaining in the beds. Complete control of *C. formicarius* was obtained in barrels with 1 oz. paradichlorobenzene to 50 lb. tubers and an exposure of 21 days, and in storage mounds with 1 oz. to 50 lb. and an exposure of 28 days or with 1·5 oz. and an exposure of 21 days, but up to 3 oz. paradichlorobenzene to 50 lb. with an exposure of 21 days failed to give consistently satisfactory results in seed beds. Temperatures as low as 18°F. on two successive nights were experienced during the experiments. Paradichlorobenzene is very economical to use, and the fumigation apparently reduced or retarded soft rot (*Rhizopus nigricans*). Fumigated tubers sprouted later than others, but there was no significant reduction in the number of plants eventually produced by them.

Wisecup (C. B.). **Decrease in Effectiveness of stored Pyrethrum Dusts as shown by biological Tests with the Celery Leaf Tier in the Laboratory.**—*J. econ. Ent.* **29** no. 5 pp. 1000–1003. Menasha, Wis., October 1936.

In view of the great seasonal fluctuations in infestation of celery in Florida by *Phlyctaenia rubigalis*, Gn. (celery leaf-tier) and the consequent impossibility of foretelling the amount of pyrethrum needed each season for its control, experiments were carried out under laboratory conditions on the effect of storage on the toxicity of the dust. One-pound samples of pyrethrum dusts and mixtures of equal parts of pyrethrum and tobacco (the pyrethrum guaranteed to contain not less than 0·9 per cent. pyrethrins) were stored for periods of 1–3 years in heavy paper bags within tins, in an open room in the laboratory.

In some cases the top of the bag was folded and the tin tightly closed, and in others the bag and tin were open. Tobacco dust is almost the only diluent used in the area. None of the tobacco dust used had alone a measurable effect on the larvae. For the toxicity tests, 10 nearly mature larvae of *P. rubigalis* were exposed on a petri dish to settling clouds of dust sufficient to deposit approximately 0·3 mg. per sq. in. ; food was added and examinations made after 24 and 48 hours. In the following analysis of the results, the percentage of mortality caused by each substance is given in brackets. The significant difference was 11·3 per cent. The difference between fresh pyrethrum (95·3) and samples of undiluted pyrethrum stored in closed containers for one (97·3), two (88) and three (84·6) years was not significant. No difference was conclusively demonstrated between the fresh pyrethrum and a fresh mixture of tobacco and pyrethrum (86·6). Mixtures of pyrethrum and tobacco stored in closed containers for one (83·3) and two (81·3) years did not differ significantly from the fresh mixture, but the samples stored in open containers for one (72) and two (65·3) years were significantly inferior. Undiluted pyrethrum stored for one year in an open container (88·6) did not differ significantly from the fresh sample.

Billings (S. C.). **Notes on Clothes Moth Breeding.**—*J. econ. Ent.* **29** no. 5 pp. 1014–1016, 3 refs. Menasha, Wis., October 1936.

During work on the breeding of *Tineola biselliella*, Humm. (clothes moth), it was established that clean woollen goods are nutritionally deficient for newly hatched larvae, which feed slightly or not at all

on them. The larvae will feed on woollen material that has been imperfectly cleaned or exposed to normal quantities of house dust for 10 days or more, but are not as a rule able to complete their growth. Larvae will feed extensively on wool around dead adults and may complete their development if such adults are numerous. Larvae removed from suitable diet to clean woollen material may feed extensively, but the smaller ones produce undersized adults or do not complete their development. Certain food stains stimulate larval growth, but many do not permit pupation. Certain animal pelts, such as rabbit and fox, allow of continuous development without supplementary treatment. Yeast autoclaved at 248°F. for 1–5 hours was found to be an improvement on ordinary yeast [*R.A.E.*, A **21** 78], which, with woollen material, is a complete diet for the larvae. Eggs laid on it give rise, at 80°F., to first generation adults in 42–50 days, as against 55–60 on ordinary yeast, and jars do not need to be washed at the end of each generation. It is sufficient to add fresh wool and autoclaved yeast, for at least two or three generations. Autoclaving fish meal [**21** 474] did not prevent a high rate of mortality after the first generation of adults emerged. Eggs can be obtained in considerable quantities by using a cage consisting of a fine-mesh wire cylinder covered with muslin and having a 14-mesh wire gauze bottom, under which is fastened a piece of woollen material. Fifteen newly emerged adults, of which about half are usually females, are introduced through a hole in the muslin, normally covered with a removable gauze top, and in a dark place, at 80°F., 50–75 eggs are generally obtained. At the end of 48 hours, the eggs are shaken into a container through a funnel. They hatch in 3–4 days.

Livingstone (E. M.) & Reed (W. D.). **Insect Fauna of Cured Tobacco in Storage in the United States.**—*J. econ. Ent.* **29** no. 5 pp. 1017–1022, 7 refs. Menasha, Wis., October 1936.

Because of the necessity for "ageing" cured tobacco for 2–4 years, as many as 2,380 million pounds are stored at all seasons of the year in the United States, in one or other of two types of warehouse, which are described. Of the insects found associated with it, *Ephestia elutella*, Hb., has comparatively recently become a pest of tobacco [*R.A.E.*, A **19** 215, etc.] showing a preference for the higher grades [**19** 590, etc.]. It requires a moisture content of the tobacco of 11–15 per cent. [*cf.* **21** 458], and the optimum moisture content is produced by a relative humidity of 65–75 per cent. Only a small percentage of the newly hatched larvae become established; but as eggs are abundant and natural enemies few, infestation has become rather serious on cigarette tobaccos. The larvae are parasitised by *Microbracon hebetor*, Say, which, however, is never abundant enough to give satisfactory control, and *Mesostenus gracilis*, Cress., which occurs only rarely. *Seius* sp. is commonly found living as a predator on adults. It usually attaches itself to the vertex of the head or to the thorax near the bases of the wings, but may be found on any section of the body. *Theridion tepidariorum*, Koch, snares adults in its webs, but the females caught have generally laid all their eggs, as young ones are able to escape. Occasionally the spider settles in the receptacles of suction light-traps and feeds on the moths that are captured. An unidentified mite related to the genus *Laelaps* attacks the eggs and has been found feeding on them in the receptacles of suction light traps.

Larvae of *Lasioderma serricorne*, F., the most destructive pest of cured tobacco, feed on many types but preferably the high-grade cigarette type. Increase is very rapid. *Aplastomorpha calandrae*, How., the only insect parasite of the larvae that has been found in tobacco warehouses, is not normally important as a control factor, only becoming abundant when the host is present in large numbers. Probably the adult parasite finds it difficult to make its way into the tightly packed tobacco through the feeding tunnels of the larvae, unless they cross, in which case it may be able to enter easily through the exit hole of an early maturing larva. *Cephalonomia gallicola*, Ashm. [**22** 642] has not been found in tobacco warehouses. *Pediculoides ventricosus*, Newp., is sometimes found in cured tobacco preying on larvae of *L. serricorne*, but has not been observed attacking the larvae of *E. elutella* under natural conditions. *Tenebroides mauritanicus*, L., a pest of grain products, is sometimes found in small numbers in tobacco warehouses preying on the immature stages of tobacco pests, particularly larvae of *L. serricorne*. It has not been observed feeding on the tobacco. The larvae and adults of *Thaneroclerus girodi*, Chevr., which has been collected only in Florida from stored tobacco, are predacious on all stages of *L. serricorne*.

The larvae of *Aglossa* sp. (presumably *cuprealis*, Hb.) sometimes feed on tobacco that is mouldy or decayed. Lists are given of several insects found by the authors in cured tobacco, but not observed to feed on it, and of a few recorded from tobacco in the literature.

FLANDERS (S. E.). *Coccidophilus citricola* **Brèthes, a Predator Enemy of Red and Purple Scales.**—*J. econ. Ent.* **29** no. 5 pp. 1023–1024, 7 refs. Menasha, Wis., October 1936.

In September 1934, a consignment of *Coccidophilus citricola*, Brèthes, was received in California from Brazil. This Discolomid, all stages of which are briefly described, is probably generally distributed throughout sub-tropical and temperate South America. It is predacious on several scale insects, including *Lepidosaphes beckii*, Newm., and *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask. [*R.A.E.*, A **1** 350; **2** 207, 480; **11** 244; **21** 162], but was not effective in reducing the abundance of *L. beckii* and other Coccids on *Citrus* in Brazil. The consignment included 12 live adults, from which a stock was reared in the insectary. The host scales were propagated on mature gourds or squashes, which remain in good condition for 6–12 months in a warm, dry room; this made possible the production and liberation of many thousands of beetles. Immature stages were found in the field in August 1936, and it is thought that the beetle has become established in California. The eggs are laid from 5 days after emergence beneath the covering of the scale, and hatch in 8–9 days, at 80°F. The feeding period of the larvae lasts 10 days, the whole larval stage 13–20 days, and the pupal stage 5 days.

FLANDERS (S. E.). **Japanese Species of** *Tetrastichus* **parasitic on Eggs of** *Galerucella xanthomelaena* **(Schrank).**—*J. econ. Ent.* **29** no. 5 pp. 1024–1025, 1 ref. Menasha, Wis., October 1936.

As attempts made during the last 30 years to establish the egg parasite, *Tetrastichus xanthomelaenae*, Rond., in the United States against the elm leaf beetle, *Galerucella luteola*, Müll. (*xanthomelaena*,

Schr.) [*R.A.E.*, A **24** 294, etc.] were unsuccessful and it was observed in Japan that eggs of *G. maculicollis*, Mots., on elms were parasitised by an apparently undescribed species of *Tetrastichus*, consignments of the Japanese parasite were forwarded in 1934 [**23** 379] and 1936 to California, where it was hoped to establish it against *G. luteola*. In the 2 shipments, 35 and 45 per cent. of the egg masses were parasitised. Only one parasite matured in each host egg. The parasites emerged over a period of 24 days, the emergence from a single egg-mass being completed within 10 days. The sexes occurred in equal numbers. On receipt of each shipment, some full-grown larvae were present as well as pupae. Many full-grown larvae found after all the adults had emerged appeared to be healthy but did not complete development. The material was 14 days in transit at 38°F. This exposure apparently inhibits the development of both the host embryo and the " prepupal " stage of the parasite. It had also apparently affected the males in the pupal stage, as pairing did not occur in the laboratory, but the progeny of the unmated females developed sucessfully in eggs of *G. luteola*. At 70°F., the larva was full-grown 7 days after oviposition and pupated 6 days later, the pupal stage lasting 10 days ; and at higher temperatures the life-cycle was sometimes completed in 14 days. Adults must imbibe liquids within 20 hrs. of emergence. At 80°F., eggs are not fully formed until 3–4 days after emergence. After oviposition has begun, the female begins to feed on the host eggs. A 6-day old female was placed for 13 hrs. in a vial containing a mass of 15 eggs. After 7 days, 12 each contained a full-grown parasite, 1 contained a first-instar larva, and in the other 2 embryonic development remained incomplete, although they were apparently unparasitised.

GILMORE (J. U.). *Geocoris punctipes* **Say observed as predaceous upon Eggs of** *Phlegethontius* **sp.**—*J. econ. Ent.* **29** no. 5 p. 1025. Menasha, Wis., October 1936.

In June 1936, a nymph of the Lygaeid, *Geocoris punctipes*, Say, was observed near a partially collapsed egg of a Sphingid, *Protoparce* (*Phlegethontius*) sp., on tobacco in North Carolina. The nymph was captured and continued to feed on eggs of *Protoparce* before and after it had become adult. Other nymphs and adults in captivity fed on one another. It is believed that this is the first record of *G. punctipes*, which was plentiful in tobacco fields on 22nd June, attacking eggs of *Protoparce*, though it has been recorded as predacious on *Epitrix parvula*, F. [*R.A.E.*, A **11** 570].

HAYDAK (M. H.). **A Food for rearing Laboratory Insects.**—*J. econ. Ent.* **29** no. 5 p. 1026. Menasha, Wis., October 1936.

Galleria mellonella, L., *Achroia grisella*, F., *Oryzaephilus surinamensis*, L., *Plodia interpunctella*, Hb., *Trogoderma* spp. and other Dermestids, and grasshoppers have been successfully reared on a mixture of maize flour, whole wheat flour, skim-milk powder, dried powdered yeast and wheat middlings or bran (4 : 2 : 2 : 1 : 2 parts by weight) combined with an equal quantity by weight of a mixture of honey and glycerine (1 : 1 by volume). The dry ingredients should be thoroughly mixed and stored in a tight container. The honey and glycerine can be stored at room temperature. After the mixture has stood for about 24 hrs., it is placed with the insects in jars covered with gauze, and the

whole kept at 32°C. [89·6°F.] and 75 per cent. relative humidity. The proportions of dry and moist ingredients can be changed according to the species of insect. In the case of insects that feed on leaves, a dish containing cotton and filled with water should be placed close to the food.

LYLE (C.). **Long Survival of *Gibbium psylloides* Czemp.**—*J. econ. Ent.* **29** no. 5 p. 1026. Menasha, Wis., October 1936.

An infestation of the Ptinid beetle, *Gibbium psylloides*, Czemp., was maintained for at least 18 years in a glass jar of wheat bran in Mississippi. During the period nothing was added, and a layer of dead beetles, 1 in. thick, accumulated on top of the bran. The infestation died out in 1934, during the absence of the author, when the jar may have been exposed to too much sun.

THOMAS (W. A.). **A Crane Fly Larva attacking newly set Strawberry Plants.**—*J. econ. Ent.* **29** no. 5 pp. 1026–1027. Menasha, Wis., October 1936.

During March 1936, larvae of the Tipulid, *Nephrotoma ferruginea*, F., were found to be causing severe injury to young strawberry plants in North Carolina. They were also destroying young tobacco seedlings. There were 1–3 larvae on each infested strawberry plant, and many in the soil between them. They were just below the surface of the earth, which they had thoroughly pulverised. Late in March, larvae of all instars were present, and a few pupae were protruding slightly above the surface of the soil. Emergence of adults in cages began on 20th April and reached a peak in 5 days. Second-generation adults were observed in the field in the first week in May. A poisoned bait of calcium arsenate and wheat middlings (1 : 20 by weight) with the addition of molasses and water greatly reduced the infestation.

PAYNE (N. M.). **Injury to Lumber by *Hadrobregmus carinatus* Say.**—*J. econ. Ent.* **29** no. 5 p. 1027. Menasha, Wis., October 1936.

During the winter of 1935–36, it was discovered that the elm joists supporting a basement floor of a house in southern Minnesota had been eaten through, except for a thin shell, by the Anobiid, *Hadrobregmus carinatus*, Say. One joist contained some heartwood, which was damaged. A similar infestation of elm sapwood was reported from eastern Minnesota. The emergence holes of *Hadrobregmus* are somewhat larger than those of *Lyctus*, and the frass somewhat coarser.

SMITH (L. E.), SIEGLER (E. H.) & MUNGER (F.). **Potential new Insecticides.**—*J. econ. Ent.* **29** no. 5 p. 1027. Menasha, Wis., October 1936.

Tested in the laboratory by the apple plug method [*R.A.F.*, A **21** 338], *p*-nitroiodobenzene, thiocoumarin and phenothioxin showed high initial toxicity to larvae of the codling moth [*Cydia pomonella*, L.], but they lose much of their effectiveness when exposed as a spray deposit for a week or so. A means of preventing this loss of toxicity is being sought.

Ritcher (P. O.) & Calfee (R. K.). **Wider Uses for Nicotine.**—*J. econ. Ent.* **29** no. 5 pp. 1027–1028. Menasha, Wis., October 1936.

It has been found in Kentucky that free nicotine may be incorporated in highly refined petroleum base oil to give a stable solution, which, containing 1–3 per cent. nicotine and applied as a mist spray, has not scorched tender foliage and, in the laboratory, has given a high percentage of kill of many pests, including mealybugs, Aleurodids and adult green June beetles [*Cotinis nitida*, L.]. The toxicity of nicotine in oil, like that of pyrethrum in oil, varies according to the species of insect against which it is used, the nicotine being especially toxic to those with a high metabolic rate.

Brannon (L. W.) & Howard (N. F.). **Observations on Control of Mexican Bean Beetle in Association with Powdery Mildew Disease on Snap Beans.**—*J. econ. Ent.* **29** no. 5 p. 1028. Menasha, Wis., October 1936.

In experiments in Virginia in 1935, *Epilachna varivestis*, Muls., was successfully controlled on beans with magnesium arsenate (2 lb. to 50 U.S. gals. water), commercial barium fluosilicate (3 lb. to 50 U.S. gals.), synthetic cryolite (3 lb. to 50 U.S. gals.), water suspensions of derris and cubé [*Lonchocarpus*] (rotenone content of sprays, 0·02 per cent.), and dusts of synthetic cryolite (6 : 4 with a carrier), and derris and cubé root (0·5 per cent. rotenone) ; and powdery mildew disease (caused by a fungus of the family Erysiphaceae) was also controlled when 2 lb. wettable sulphur was added to the sprays, or when sulphur was used as the diluent for the dusts.

McDaniel (E. I.). **Injury to Pines by *Tortrix* (*Amelia*) *pallorana* Rob.**—*Quart. Bull. Mich. agric. Exp. Sta.* **19** no. 2 pp. 92–94, 2 figs. East Lansing, Mich., November 1936.

A brief account is given of damage caused in 1936 to young pines in south-western Michigan by the larvae of *Tortrix pallorana*, Rob., a polyphagous Tortricid that occurs throughout the north-eastern United States. Injury was caused to all of several species of pines, 4–6 years old, planted together over an area of about 200 acres, but the larvae showed a marked preference for white pine [*Pinus strobus*], about 95 per cent. of the new growth being killed. They webbed 2 or more tender shoots together and tunnelled into the new growth, as well as feeding on the young needles. By 25th May, when the infestation was discovered, they were almost full-grown ; some pupated in cages on 2nd June, and adults emerged a fortnight later. Two more generations occurred on other food-plants in 1936, but there was no further infestation of pine, the larvae apparently only being attracted to the tender new growth that develops in early spring. They were readily controlled by contact or stomach insecticides, but, in view of the risk of injuring the new growth of pines, a contact insecticide should be preferred. A spray of nicotine sulphate and soap is recommended, if necessary.

Boyce (H. R.). **Laboratory Breeding of *Ascogaster carpocapsae* Vier. with Notes on Biology and larval Morphology.**—*Canad. Ent.* **68** no. 11 pp. 241–246, 9 figs., 3 refs. Orillia, November 1936.

During 1933-35, 9,849 adults of *Ascogaster carpocapsae*, Vier., reared in a laboratory from material collected in Ontario, were liberated in

various districts of British Columbia against *Cydia pomonella*, L. on apple. Notes are given on the hosts and distribution of the parasite, and the immature stages are described. The author differs from J. A. Cox [*R.A.E.*, A **20** 467] in finding only 3 larval instars. The adults, which are positively phototropic, pair almost immediately after emergence. They lived for a number of days on cane sugar and water, but at 80°F., without food or water, died in 12-24 hours. The males lived 39–50 days and the females 33–60, when stored in an ice box, and brought to 70°F. and fed for 1 hour daily. The females usually began to oviposit within 24 hours of fertilisation, in any stage of the host egg. The eggs were laid singly, but a female frequently returned to oviposit in an egg that had already been parasitised by it or by other females. If the host egg was in the early stages of development, the parasite egg was laid in the cytoplasm, but if the host embryo had developed for 38 hours or more at 80°F., the egg was often deposited in the developing embryo.

Laboratory breeding, which was begun in the autumn of 1932, was carried on mainly with *C. molesta*, Busck, as host, as 8–10 larvae, as against 1 of *C. pomonella*, could be reared per apple. The oviposition cage was of muslin on a wooden framework, having a sliding glass front, and a bottom of solid wood, covered with sand, which was moistened daily. Cubes of sugar were provided for food. Host eggs, 16–18 or 38–42 hours old, were exposed for 2–6 hours, on waxed paper on the side of the cage through which most light entered. The best results were obtained with bright sunshine and a temperature of 70°F. When the older eggs were used, 22 per cent. more parasites were obtained. After being exposed to the females, the eggs were removed to a petri dish until ready to hatch, when they were transferred to apples lightly scored with a scalpel. The apples were kept in jars or trays with wire gauze bottoms until the host larvae were mature and had entered strips of corrugated paper, which were then transferred to tumblers or jars for emergence. Adult parasites sent by rail to British Columbia in 1933 in ice boxes and iceless containers arrived in good condition, but in 1934, when all consignments were sent in iceless containers, they arrived in poor condition on account of the heat. Transport by air-mail was unsuccessful in 1935. Finally, a very satisfactory cage was devised, consisting of a light wooden frame covered with muslin. A ladder of muslin is suspended over light wire rods, inserted in opposite sides of the frame. Several moist rolls of dental cotton are put into the cage at the same time as the parasites. The cage is packed in a metal ice box and partly insulated from contact with the metal sides by heavy pieces of cardboard. The ice-box is re-iced as required during the journey. The number of parasites liberated in each area is given. Larvae and pupae were recovered in 1935 from an orchard where liberations had been made in that year.

JACOBSON (L. A.). **Say's Grain Bug, *Chlorochroa sayi* Stål, in Canada.**—*Canad. Ent.* **68** no. 11 pp. 259–260. Orillia, November 1936.

In view of the finding of *Chlorochroa sayi*, Stål, in Alberta in 1935, brief notes are given on its history in the United States, and on its bionomics and importance as a pest of cereals [*R.A.E.*, A **7** 398]. It appeared in Montana in 1931 and has since been causing considerable damage in the northern part of that State [*cf.* **23** 656]. In Alberta,

adults were observed on wheat during July and August 1935 and in the autumn, hibernating adults were found in the early spring of 1936, and nymphs of the first generation matured about the first week in July. At this time, a survey showed that the bug was present in all the grain-growing districts of southern Alberta. It is apparently able to withstand extreme cold while in hibernation, as during February 1936 the mean temperature at Lethbridge was —10·16°F., the lowest on record.

Blanchard (E. E.). **Descripción de icneumonoideos argentinos.**—*An. Soc. cient. argent.* **122** no. 6 pp. 398–407, 4 figs. Buenos Aires, December 1936.

The following new parasites are described from Argentina: the Braconid, *Austrodolops eremitae*, gen. et sp. n., from the larva of *Cecidoses eremita*, Curtis; *Ephialtes* (*Calliephialtes*) *argentinus*, sp. n., from the larva of *Cydia* (*Laspeyresia*) *molesta*, Busck; and *Parapechthis bazani*, gen. et sp. n. [*Pimpla, sens. lat.*] from the pupa of *Alabama argillacea*, Hb.

Taylor (T. H. C.). **The Biological Control of an Insect in Fiji. An Account of the Coconut Leaf-mining Beetle and its Parasite Complex.**—Roy. 8vo, 239 pp., 2 maps, 23 pls., 17 figs., 28 refs. London, Imp. Inst. Ent., 1937. Price 12*s*.

In this work, an account is given of a campaign begun in Fiji in 1929, for the biological control of *Promecotheca reichei*, Baly, a Hispid injurious to coconut palms. In normal circumstances, the generations overlap so that the various developmental stages occur together, and a satisfactory equilibrium is maintained by the inter-relations of indigenous primary and secondary parasites. In comparatively recent years, however, this equilibrium has been upset in certain parts of Fiji by *Pediculoides ventricosus*, Newp., which was first recorded there in 1921, though it had probably been introduced long before. This mite attacks the larvae, pupae and freshly emerged adults of *Promecotheca*, multiplies rapidly, and periodically eliminates all the larvae and pupae in a site of infestation. After this, its numbers decline, but rise again with those of the host. As a result, a condition is produced and maintained in which the stages of *Promecotheca* do not overlap, and in this condition it was no longer controlled by indigenous parasites and so assumed the status of a pest. It was therefore necessary to introduce a parasite that would be effective in the presence of *Pediculoides*.

The various sections of the book form, so far as possible, a consecutive account of the campaign, which consisted of an investigation by the author of *P. reichei* in Fiji, a preliminary survey by R. W. Paine of parasites of an allied species, *P. nuciferae*, Maulik, on coconut in Java, a continuation of this survey by the author, and the introduction into Fiji from Java in 1933 of *Pleurotropis parvulus*, Ferrière, which had been found to be theoretically suitable and which suppressed the Hispid rapidly and effectively. One section deals with the food-plants, distribution, morphology and bionomics of *Promecotheca reichei* and the climatic conditions affecting it. This is followed by full accounts of six of the parasites and predators associated with it in Fiji before 1933 and brief notes on the remaining

ones. The next section deals with its economic importance, including the causes, course and termination of outbreaks in which the stages overlap and of those in which they do not. An account of the extent of natural control exercised by the indigenous parasites and other factors concludes the review of the preliminary work in Fiji. Further sections are devoted to the search for parasites capable of controlling *Promecotheca reichei* in the abnormal one-stage condition, the hosts, distribution, morphology, bionomics, etc., of *Pleurotropis parvulus*, and its introduction and effectiveness, together with notes on two other parasites that proved valueless, and general considerations on biological control. In the last section, the methods employed for breeding and studying *Promecotheca* and its parasites and for collecting data in the field are discussed. Twenty-three plates from photographs and drawings by the author are appended.

Leroy (J. V.). **Observations relatives à quelques insectes attaquant le caféier.**—*Publ. Inst. Etude agron. Congo belge* Sér. sci. no. 8, 30 pp., 9 figs., 5 refs. Brussels, 1936. Price *Fr.* 10.

In this account of some coffee pests in the Belgian Congo, the author has drawn on the literature to supplement his own observations in the field and laboratory. The pests discussed are *Epicampoptera marantica*, Tams, *E. vulvornata*, Hering, *E. andersoni*, Tams, *Leucoptera coffeella*, Guér., *Stephanoderes hampei*, Ferr., and *Pseudococcus lilacinus*, Ckll. Descriptions are given of the larvae and adults of the species of *Epicampoptera* and all stages of the other insects.

E. marantica and, less commonly, *E. vulvornata* occur on *Coffea robusta* in the north-east of the Belgian Congo, and *E. andersoni*, which is found on *C. arabica* there and in the east, caused serious damage to one plantation after it had suddenly increased in numbers. *E. marantica* is nocturnal in its habits. In rearing experiments, the females laid an average of 450 eggs in two or three days, 325 about 12 hours after pairing. They were deposited in irregular masses on coffee leaves or on the walls of the cage. *E. vulvornata* and *E. andersoni* laid eggs in batches of 15–30. The egg, larval and pupal stages of *E. marantica* lasted 4–5, 18–30 and 8–11 days respectively. The larvae fed at first on the parenchyma of the leaves, and after the first moult attacked them from the edges. Some feeding is done on cloudy days, but most occurs during the night. Pupation takes place in rolled leaves. The Tachinid, *Zenillia* (*Carcelia*) *angulicornis*, Villen., was occasionally found parasitising *E. marantica*. Hand-collection of the pupae is normally the cheapest method of control, but in severe infestations arsenical dusts are recommended. Excessive shade should be avoided.

In rearing experiments carried out during 1933 in Uele at an altitude of about 2,000 ft., females of *L. coffeella* laid eggs in batches on the upper surface of the coffee leaves. The larvae hatched in 6–8 days and at once bored into the leaf. If removed from their galleries and placed on the leaves, they made no attempt to re-enter, but either pupated or died. The larval and pupal periods lasted 10–12 and 8 days, respectively, pupation occurring on the underside of the leaves. In Ituri, at an altitude of 5,900 ft., the egg, larval and pupal stages lasted 7–9, about 20 and 8–9 days. The different lengths of the stages in various parts of the world are compared in a table. Two Chalcidoid parasites were bred from *L. coffeella*, and a Braconid,

which was less common. At one period nearly all the swelled leaves that were opened contained parasites, up to 8 being found in each. The author suggests that infested leaves should be placed in emergence cages so that the parasites can be collected and released and the moths be destroyed.

The distribution of *S. hampei* is noted, and the type of injury to coffee is discussed. It is the most important coffee pest in the Belgian Congo and prefers *Coffea robusta*, although it also infests *C. arabica*. The female oviposits in ripe berries of a certain hardness, depositing 2–9 eggs at the end of the gallery that it has bored. The egg, larval and pupal stages lasted 6–8, 15–26 and 8–9 days [*cf. R.A.E.*, A **11** 236]; the incubation period was ascertained by observation of eggs deposited by females in thin slices of the berry placed between glass slides. Insect and fungous parasites of *Stephanoderes* are discussed [*cf.* **23** 212; **25** 10], and their introduction is advised into all plantations in which they do not occur. Control methods employed in various parts of the world are briefly summarised.

In view of the fact that *P. lilacinus* has for some time been present in the coffee areas of the Belgian Congo, work done in Kenya [where the species concerned is now recognised to be *P. kenyae*, Le P., and not *P. lilacinus* [*cf.* **23** 607)] is summarised [*cf.* **17** 693; **18** 569; **21** 33, etc.].

LEROY (J. V.). **Observations relatives à quelques hémiptères du cotonnier.**—*Publ. Inst. Étude agron. Congo belge* Sér. sci. no. 10, 20 pp., 18 pls., 22 refs. Brussels, 1936. Price *Fr.* 35.

An account is given of experiments to ascertain the relation of certain Capsids and the Jassid, *Empoasca facialis*, Jac., to malformations of the leaves of cotton in the Belgian Congo, together with observations on the biology of some of them. The types of injury are described, with details of that commonly known as "la frisolée," in which large holes appear in the leaves. Experiments in which 3 species of Capsids associated with this type of injury were fed separately on cotton plants showed that it was produced by nymphs and adults of *Lygus simonyi*, Reut. (*vosseleri*, Popp.), and not by *Deraeocoris oculatus*, Reut., or *Sthenarus leucochilus*, Reut. *L. simonyi* feeds mainly on the young leaves, not yet fully expanded, and on the flower buds. The punctures result in the formation of small brownish-black spots of dead tissue that split as the leaf grows, so that increasingly large perforations bordered with brown or black appear. When the flower buds are attacked and perforated at their base, they fall after 4 or 5 days [*cf. R.A.E.*, A **24** 106, 107]. The lesions caused by the Capsid, *Helopeltis bergrothi*, Reut., are discussed from the literature [**22** 78; **23** 99]. Those caused by *Empoasca facialis* are due to the feeding by the nymphs and adults on the lower surface of the cotton leaves, mainly on the veins. The leaves curl, the edges may become reddish and dry up, the buds drop, and the whole plant is stunted.

Attempts to obtain the eggs of *L. simonyi* were unsuccessful. Measurements are given of the later nymphal instars and adults. Natural enemies of the nymphs included an unidentified Hymenopterous parasite and *Deraeocoris oculatus*. *D. oculatus* was found to be an active predator, feeding on nymphs of *L. simonyi* and Jassids and on Aphids. The nymphs did not survive on cotton leaves in the

absence of these insects. The eggs of *D. oculatus* and *H. bergrothi* were laid in the tender parts of the cotton shoots, and those of *E. facialis* in the veins of the leaves. The durations of the egg and nymphal stages in days, as determined by the rearing of 50 nymphs, were 12–14 and 23 for *D. oculatus*, 6–8 and 8 for *E. facialis*, and 13–17 and about 40 for *H. bergrothi*. About 0·5 per cent. of the nymphs and adults of *H. bergrothi* were destroyed by an unidentified Hymenopterous parasite.

Pest on Ramie.—*E. Afr. agric. J.* **2** no. 3 p. 187. Nairobi, November 1936.

Larvae of *Acraea esebria*, Hew., which normally feed on indigenous Urticaceae, have recently caused some damage to ramie plants [*Boehmeria nivea*] in Kenya. In view of the fact that this Nymphalid may become a serious pest of ramie when it is grown more extensively, measures for control are suggested; they include collection of the larvae by hand or by shaking them from the plants on to sheets, and, in cases of severe infestation, spraying with lead arsenate (2½ lb. in 100 gals. water).

Notley (F. B.). *Pseudococcus kenyae* (**Le P.**) **and Climate.**—*E. Afr. agric. J.* **2** no. 3 pp. 217–219. Nairobi, November 1936.

In the Central Province of Kenya, *Pseudococcus kenyae*, Le P. [*cf. R.A.E.*, A **23** 607; **24** 219], which is probably an introduced species, is now present wherever coffee is grown and has come into equilibrium with its surroundings, so that damage due to it only varies seasonally. Infestation is severe from an altitude of 4,500 ft. (below which coffee is not grown) to 5,000 ft., and slight in normal years above 5,500 ft. In Bukoba [Tanganyika] and Uganda, where *P. kenyae* has recently been identified, it is only a minor pest, although it attacks both *Coffea robusta* and *C. arabica*, which are grown at altitudes down to 4,000 ft. The parasites and predators attacking it in Uganda do not appear to be more efficient than those in Kenya. *Anagyrus aurantifrons*, Comp., which is the most important parasite in Uganda, though it gives only slight control, never attacks *P. kenyae* in Kenya, where it is everywhere present on *P. filamentosus*, Ckll. It was, however, bred successfully in Kenya on starved individuals of *P. kenyae*. It is suggested that this reduced resistance of *P. kenyae* to a non-specific parasite indicates a lowered vitality in Uganda. Although there is no evidence of a difference of temperature in Kenya and Uganda, it is possible that the greater humidity of the atmosphere in Uganda (owing to the vicinity of Lake Victoria) may reduce the reproductive rate of *P. kenyae*, a hypothesis that has been supported by preliminary experiments in the laboratory in Kenya and by work in Java on other mealybugs [**23** 12], or that the eco-climate of the coffee bushes may be concerned. In Uganda, but not in Kenya, the outbreaks of *P. kenyae* are correlated with poor soil and unshaded coffee, possibly because it is only in such bushes that sufficiently high temperatures and low humidities occur. In Kenya, the climate is almost always favourable, but intense outbreaks only occur when an ample supply of suitable food is available during the flowering or fruiting of the tree.

CORBETT (G. H.). **Division of Entomology. Annual Report for the Year 1935.**—*Gen. Ser. Dep. Agric. S.S. & F.M.S.* no. 24 pp. 41–53, 1 graph. Kuala Lumpur, 1936.

Investigations on the natural enemies of *Cosmopolites sordidus*, Germ., on banana in Malaya showed that the immature stages were attacked by the larvae of the Hydrophilid, *Dactylosternum hydrophiloides*, Macleay, and by the Histerids, *Plaesius javanus*, Er., *Platysoma* sp. and *P. abruptum*, Er., and the Staphylinid, *Belonuchus quadratus*, Kraatz. Other Hydrophilids frequently associated with banana stumps were *Dactylosternum abdominale*, F., *D. subquadratum*, Fairm., and *Omicrogiton insularis*, Orchym. A few Rhynchota are recorded as attacking eggs of *Cosmopolites* in the laboratory.

Heavy dressings of lead arsenate destroyed the larvae of *Anomala aureola*, Hope [*cf. R.A.E.*, A **24** 105], damaging the roots of grass on a golf course in the Cameron Highlands, but scorched the turf. The injury is thought to have been due to an increase in the soluble arsenic resulting from the action on the lead arsenate of the organic acids in the peaty soil. As the larvae prefer spongy, poorly drained soil, which consists for the most part of raw jungle humus, the replacement of the top undecomposed layer of this by mineral soil would probably be an efficient method of control. The Scoliid parasite, *Campsomeris prismatica*, Sm., which was abundant in another locality in August, was reared successfully on larvae of *A. aureola* and liberated in the Cameron Highlands. A second species, *C. leefmansi*, Betr., is to be imported from Java.

Observations for 3 years on *Diatraea auricilia*, Ddgn., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), infesting rice, have shown that the number of egg-masses of both insects is generally high from November to April, a maximum being reached in March and April, and low from May to October [*cf.* **21** 573; **24** 104]. The percentages of tillers killed by the larvae did not appear to be correlated with the numbers of egg-masses collected or with yields. It is thought that tillers more than four months old are not seriously affected, although an earlier attack may almost completely destroy the crop. In one district, 98 per cent. of the rice was infested by the larvae of *Spodoptera mauritia*, Boisd., and a rot that followed their attack was considered responsible for the failure of the plants to flower. *Thrips oryzae*, Williams, and *Sogata* sp. were troublesome in some nursery beds. *Nymphula fluctuosalis*, Zell., was reported on one occasion damaging seedling rice, and the Ortalid, *Poecilotraphera gamma*, Hend., was bred from rice stems, the larvae having probably been associated with the faeces of borers.

On coconuts, *Artona catoxantha*, Hmps., was reported in the Sepang district for the first time since 1922. *Chalcocelis albiguttata*, Snell., was prevalent there in March, but the larvae were heavily parasitised, and a fungus appeared to cause a considerable mortality amongst the pupae. Larvae in a coconut stump, almost certainly those of *Oryctes rhinoceros*, L., were parasitised by *Scolia ruficeps*, Sm., and the introduction of this Scoliid into Samoa for the control of *O. rhinoceros* on coconuts there has been suggested. *Setora nitens*, Wlk., was abundant on oil palm [*Elaeis guineënsis*] in one locality. The termite, *Amitermes globosus*, Hav., which makes its runs on this palm, confines its attentions to the decaying accumulations at the bases of the leaf petioles, and does not injure the crown or penetrate the trunk.

The coffee berry borer, *Stephanoderes hampei*, Ferr., did not appear to have spread into new areas, and where recommended methods of control [**21** 206] had been systematically practised, they seemed to have been satisfactory. The Limacodids, *Cania striola*, Her., and *Thosea plumbea*, Her., have recently been recorded from coffee. *Zeuzera coffeae*, Nietn., was controlled by introducing a solution of paradichlorobenzene into the stems that had been bored. A report was received that larvae of *Hulodes caranea*, Cram., *Clania crameri*, Westw., and *Semiothisa pluviata*, F., had migrated to tea from *Albizzia* and, after feeding for a short time, had returned to the *Albizzia*. Pupae of the Pierid, *Terias* (*Eurema*) *hecabe*, L., which also feeds on *Albizzia*, were found on tea bushes. None of these caterpillars caused much damage to tea, but defoliation of *Albizzia* by them appears to render it susceptible to the attacks of boring beetles, including the Cerambycid, *Xystrocera festiva*, Thoms., and the Platypid, *Platypus turbatus*, Chap., and it is suggested that other trees should be grown where shade is necessary for tea. Serious damage to tea was caused by *Gracilaria theivora*, Wlsm.

Brood of *Laccifer lacca*, Kerr, from Indian stock [*cf.* **23** 58; **24** 105] died out entirely, but a further supply is being obtained.

VAN DER GOOT (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1935.** [Diseases and Pests of cultivated Plants in the Netherlands Indies in 1935.]—*Meded. Inst. PlZiekt.* no. 87, 106 pp. Buitenzorg, 1936. Price *Fl.* 1·25.

Records are given of about 120 insect pests observed in various parts of the Netherlands Indies during 1935, showing the crops they attacked and the districts in which they occurred.

DE FLUITER (H. J.). **Onderzoekingen en waarnemingen inzake de witte luis in het jaar 1935.** [Investigations and Observations regarding Mealybugs in 1935.]—*Bergcultures* **10** nos. 25 & 27, reprint 14 pp., 1 fig., 10 graphs. Batavia, 1936.

An account is given of observations in 1935 on mealybugs [*Pseudococcus citri*, Risso, and *Ferrisiana virgata*, Ckll.] attacking coffee in the Idjen plateau, Java. In July, *P. citri* was already abundant on the shade tree, lamtoro [*Leucaena glauca*], and during the continued dry weather its numbers very greatly increased and it spread to coffee. Coffee was less infested in plantations where lamtoro had been well pruned before the mealybug appeared, thus suggesting the erroneous conclusion that lightly shaded plantations are less attacked. In old plantations, however, where lamtoro itself was shaded by dadap [*Erythrina*], *P. citri* was not abundant on lamtoro and scarce on coffee. *F. virgata* only became abundant on coffee during August, when its numbers rapidly increased to a maximum at the time that *P. citri* was already diminishing. This difference is attributed to differences in the food required by the two species.

KALSHOVEN (L. G. E.). **Twee gevallen van insecten-schade aan metalen.** [Two Cases of Injury to Metals by Insects.]—*Ent. Meded. Ned.-Ind.* **2** no. 4 pp. 59–61, 2 figs. Buitenzorg, 1st December 1936. (With a Summary in English.)

Injury to lead-sheathed telephone cables by a species of *Xylocopa* has been so frequent in Siam that the use of aerial cables has been

discontinued. The injury was apparently connected with the preparation of nesting places, which are normally formed in wood.

An instance was observed in the Netherlands Indies in which an adult of *Heterobostrychus aequalis*, Waterh., bored into tin tubes containing opium. It had developed from a larva in the soft wood of the box containing the tubes, and, when trying to make an exit-hole, had pierced the metal and changed its direction three times on coming to the viscous contents.

Chin (Meng-hsiao). **Notes on two Hymenopterous Parasites of** *Pieris rapae* **Linn.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 30 pp. 592–600, 2 figs., 11 refs. Hangchow, 21st October 1936. (With a Summary in English.)

Pteromalus puparum, L., and *Brachymeria obscurata*, Wlk., parasitise the pupae of *Pieris rapae*, L., in China. *Pteromalus* is the more abundant, having been obtained from up to 39·2 per cent. of the pupae in the field, and multiplied rapidly in an outdoor insectary. On an average, 48 adults, 84 per cent. of which were females, emerged from a single host. The pupae of other butterflies are also sometimes parasitised. *Brachymeria* is larger than *Pteromalus*, and only one adult emerges from each host. It also parasitises pupae of other Lepidoptera and even some Ichneumonids.

Liu (Chi-ying). **Studies on the Spring Brood Larvae of the Paddy Borer,** *Schoenobius incertellus* **Walker.**—*Lingnan Sci. J.* **15** no. 4 pp. 543–556, 22 refs. Canton, 17th November 1936.

A detailed account is given of investigations on the habits of the spring-brood larvae of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) in China, where it is the most serious pest of rice. On hatching, the larva usually either bores directly into the rice seedling or suspends itself by a thread so that it is carried by wind. In the latter case, it is almost certain to alight on a plant, as the plants are very close together in the seedling bed. The period between hatching and entering the seedling varies from a few minutes to several days, but is generally about 1–4 hours. The entrance holes of the larvae are generally about 2 ins. above the surface of the water. Within the stem, the larvae may settle below the outside water level. The tissue near the root of the seedling is destroyed, and the young shoot ultimately yellows and becomes brittle at the point of attack. Instead of entering the plant, however, some larvae remain on the blade or sheath, feeding on the upper epidermis. In the absence of suitable food, a larva is able to migrate from one plant to another, lowering itself by means of a silk thread to the water, on which it can crawl or drift with the current. If the interior of the plant becomes too small for the larvae, they move from the inner to the outer sheath. The author found as many as 18 larvae in a single stalk and 43 in one seedling with 2 lateral shoots.

In a series of experiments in which 100 larvae were introduced into each of a number of plots measuring about 1 ft. in diameter and containing 250 healthy seedlings, 86–98 per cent. of the larvae bored into the seedling within 24 hours of liberation. When the numbers were larger (50–200 larvae to 10 seedlings), the percentage that bored in varied from 37·5 to 62. Preliminary observations on mortality in the field showed that only 0–10 per cent. survived. This raises

some doubt as to whether the control methods employed on the seedlings are justified commercially.

In order to test the practicability of control by submerging the seedlings up to the top of the sheath, experiments were arranged to determine the ability of the larvae to descend below the water level to bore into the plant. Most of them remained above water level feeding on the leaf blades, and though a few succeeded in descending along the submerged sheath and boring into it, mortality among them was apparently high. The larvae on the surface of the leaves lived for a little over 12 days in the laboratory, and, in practice, the submergence of the leaf sheath for 12 days would injure or kill the plant. In the field, however, other factors, such as sunlight, might prevent the larvae from surviving so long. In experiments to determine the effect of submerging the stems after the young larvae had bored into them, the percentages remaining in the stem after submergence for 1, 2 and 3 days were 50, 26·3 and 30·3, and 23·8, 40 and 60 per cent., respectively, of these were dead or weakened. The other larvae escaped and were capable of boring into other plants.

Chin (Ching-mu). **Preliminary Observations on the Noctuid** *Prodenia litura* **F.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 24–25 pp. 478–480, 4 figs. Hangchow, 1st September 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 pp. 666–667. Canton, 17th November 1936.)

Brief descriptions are given of all stages of *Prodenia litura*, F., which was observed on mulberry in China, two generations occurring during the year. The average number of eggs laid by a female was 545·8; they were deposited in batches of 27–430, and hatched in an average period of 13·22 days.

Chou (Shao-mu). **The prevalence of the cotton Geometrid in Haimen, Kiangsu.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 24–25 pp. 486–487. Hangchow, 1st September 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 668. Canton, 17th November 1936.)

Cotton in a large area in the south of Kiangsu is so severely infested by Geometrid larvae that in late May they occur at the rate of 23 per sq. ft. Observation of 20 adults in the field showed that each female can lay over 1,000 eggs, more than 95 per cent. of which hatch. Hand-collection of the larvae has been the most successful method of control.

Hu (S. P.) & Tsf (K. B.). **Report on the Rice Cut-worm** (*Leucania unipuncta*, **Haw.) Outbreak of the late Crop in Tsing-yen District, Kwangtung Province, 1935.** [*In Chinese.*]—*Agric. Information* no. 196–197 pp. L1–40, 9 figs., 1 map. 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 673. Canton, 17th November 1936.)

An account is given of field investigations of the cutworm, *Cirphis* (*Leucania*) *unipuncta*, Haw., on rice in central Kwangtung, with notes on its control. The loss it causes amounts to 20–100 per cent. of the crop. Natural enemies comprise a Tachinid, 4 species of Hymenopterous parasites, and a number of predacious Rhynchota, including the Pentatomids, *Andrallus spinidens*, F., *Nezara viridula* var. *torquata*, F., *Menida histrio*, F., *Piezodorus hybneri*, Gmel. (*rubrofasciatus*, F.), and *Scotinophara lurida*, Burm., and the Coreid, *Cletus punctiger*, Dall. Some degree of control is given by ducks if the fields are flooded.

Li (K. Y.). **The Rice Stem Borer** (*Schoenobius incertellus* **Walk.**) **in Kwangsi Province.** [*In Chinese.*]—*Agric. Information* no. 196–197 p. CI–18, 1 fig. 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 678. Canton, 17th November 1936.)

In Kwangsi Province, where rice is the principal crop, it is severely infested by *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.). Eggs are laid on the tips of leaves during the hot summer and autumn nights, and hatch in about 6–10 days. The larvae, which pass through 7 instars, remain inside the stems except when migrating. The pupal stage lasts 6–10 days. Adults are active at night, and the females die soon after oviposition.

Su (Ching Ch'ao). **Destruction of rotten Bolls in Spring and Pink Bollworm Tests.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 18 p. 374. Hangchow, 21st June 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 685. Canton, 17th November 1936.)

Larvae of the pink bollworm [*Platyedra gossypiella*, Saund.] have been found in China in rotten bolls of cotton, which may serve as a source of infestation in the spring and should therefore be destroyed.

Sung (Tsu-lien). **Notes on the Mulberry Slug-caterpillar,** *Thosea postornata* **Hampson.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 23 pp. 463–466. Hangchow, 11th August 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 686. Canton, 17th November 1936.)

Notes are given on the distribution, bionomics and morphology of *Setora* (*Thosea*) *postornata*, Hmps., which attacks mulberry in Chekiang during the autumn.

Tse (K. B.). **The Control of Termites attacking Crops.** [*In Chinese.*]—*Agric. Information* no. 196–197 pp. D1–22, 22 refs. 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 4 p. 687. Canton, 17th November 1936.)

A list is given of 37 species of termites that attack cultivated plants, of which *Termes formosanus*, Shir., is the most injurious near Canton, and measures for their control are discussed.

Papers noticed by Title only.

Takahashi (R.). **Some Aphididae from South China and Hainan (Homoptera), I.** [including three new species and one new variety.]—*Lingnan Sci. J.* **15** no. 4 pp. 595–606, 3 figs. Canton, 17th November 1936.

Silvestri (F.). **Ridescrizione del genere** *Termitococcus* **Silv. con una specie nuova del Brasile e descrizione di un nuovo genere affine.** [Re-description of the genus *Termitococcus*, Silv., with a new Species (*T. carratoi*) from Brazil and Description of a new allied Genus (*Eurhizococcus* gen. n. type *Margarodes brasiliensis*, Hempel 1922).]—*Boll. Lab. Zool. Portici* **30** pp. 32–40, 7 figs. Portici, 15th December 1936.

VAYSSIÈRE (P.). **Remarques sur la morphologie et la biogéographie des Stictococcinae (Hemipt. Coccidae).**—*Livre jubil. E. L. Bouvier* pp. 349–356, 1 pl., 21 refs. Paris, 1936.

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